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The Spermatophores of *Necturus maculosus* Rafinesque

By Sherman C. Bishop

EVIDENCE has accumulated over a considerable number of years that fertilization in the mudpuppy, *Necturus maculosus,* is accomplished by means of spermatophores but, so far as I am aware, these structures have not been reported.

Kingsbury, 1895, detected the presence of active spermatozoa in the spermathecae of *Necturus* collected during the fall and winter but in the absence of definite knowledge of the egg-laying period, he was unable to decide whether the sperm had been acquired during the autumnal mating period without ovulation, or had been held over after ovulation in fall or spring. Kingsbury's dissections demonstrated internal fertilization for this form and suggested the probability that it was accomplished by means of spermatophores.

Whitman, as reported by Eycleshimer, 1906, seems to have been the first to discover the eggs of *Necturus* and establish definitely an early spring egg-laying season. Eycleshimer called attention to the segregation of females during the period of egg-laying in the spring and remarked, "During the egg-laying the males are never found with the females and where they remain is unknown."

Dawson, in 1922, writes, "Strong circumstantial evidence indicates (Kingsbury, '95) that fertilization is accomplished by the deposition of spermatophores and the reception of the spermatozoa which are borne upon the summits of the deposited spermatophores into the cloaca of the female. The time and exact manner of insemination are not known."

The writer, in 1926, described the egg-laying process and mentioned the observations of Webb which indicated an autumnal courtship suggesting that of *Triturus.* It was also pointed out that, in the streams of western Pennsylvania, the males during the egg-laying season were to be found in the deeper pools of quiet water, this point having a bearing on the question raised by Eycleshimer.

Since 1926 I have had the opportunity of studying *Necturus* in several streams in western New York and would modify my earlier statement regarding the segregation of the sexes during the egg-laying period only to the extent of reporting the occurrence of males in the same kind of situations as the females, but as before mentioned, never with them in their retreats. During the mating season in the fall, however, males and females may be found beneath the same log or stone and sometimes more than a single pair in the same retreat. On one occasion two females and a male occupied the cavity beneath a large stone.

While collecting in Salmon Creek, Monroe County, New York, on October 18, 1930, several males and females were found together. The vents of the males were enflamed, strongly everted and presented to the surface many fine tubules and two strongly diverted papillae, a condition

characteristic of the sex at this season. The cloacal glands were also enlarged and formed a ridge around the vent. Protruding from the vent of several females was a small, white, sac-like structure which upon examination was found packed with spermatozoa. The sperm mass resembled the apical portion of the spermatophore of *Ambystoma maculatum* except that it was more elongate, as if distorted by pressure of the vent.

The discovery of the sperm masses within the vents of the females suggested the possibility of securing the complete spermatophores if specimens were taken earlier in the season. On October 7, 1931, Salmon Creek was again visted and 14 specimens representing both sexes were collected and confined in aquaria.

Pairs were segregated as well as individuals of each sex, but in the five day interval that followed no spermatophores appeared, nor did any of the individuals confined together evidence the slightest interest in their mates.

Since it has been demonstrated a number of times that ovulation may be induced in amphibians by pituitary transplants and by injections of pituitary extract, it was believed likely that stimulation might induce the deposition of spermatophores, especially since the males were taken during the season when normal deposition might be expected to occur. Beginning October 12, three males were given daily injections of 2 cc. of alkaline aqueous extract of whole sheep's pituitary[1] and on October 15, one specimen responded by dropping two spermatophores on the floor of the aquarium. Two additional spermatophores were found the following day. On October 17, the same specimen deposited a jelly-like string containing two spermatophores and on the 18th a single perfect one. Several others appeared on October 22, 23, and 26.

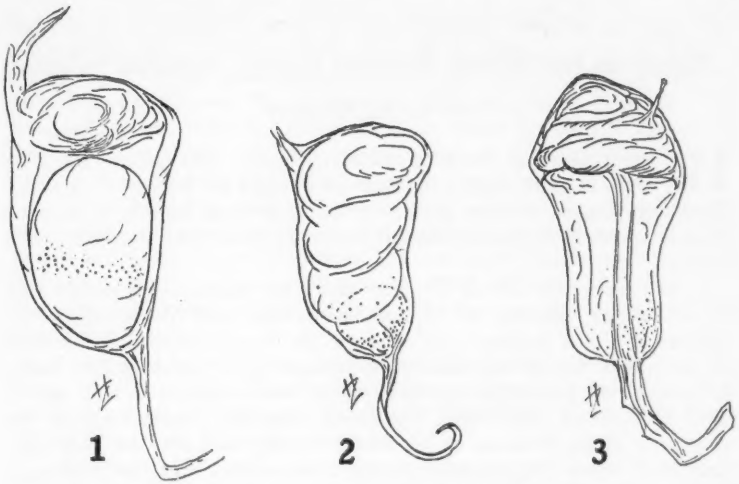
A second specimen deposited a single spermatophore and a string containing two on October 11, and one additional on October 23. No spermatophores were found in the aquarium in which a male was confined with a female, but fragments of a jelly-string appeared from time to time.

Males taken at the same time and place were retained without stimulation throughout the experiment and failed to produce a spermatophore or even strings of jelly.

The spermatophore (Fig. 1-3) consists of a gelatinous basal part supporting an apical, milky-white sperm mass. These parts are enclosed within a thin tube of clear jelly which becomes more tenuous where it passes over the sperm mass and continues from either end as a slender string. The continuation of the tube at the apical end of the spermatophore is at one side. The gelatinous basal part may be oval in outline or distinctly vase-shaped and there is no suggestion of a broad base for attachment as in the spermatophores of *Ambystoma maculatum, Triturus viridescens* and others. The terminal portion containing the spermatozoa is frequently whorled in two or more turns. A characteristic feature is the presence, in the basal part, of many small hexagonal crystals, apparently carbonate of lime.

The tube-like envelope which surrounds the spermatophores and which

[1] Product of Parke, Davis and Co., Research Department, Detroit, Mich.



with a small amount of enclosed jelly forms the connection between the spermatophores deposited in strings, suggests the sperm string of *Cryptobranchus*. It may also indicate that the spermatophores of *Necturus* are normally produced in strings and that when dropped singly they have simply been pinched off by the vent. The lack of a broad base for attachment also suggests the possibility of direct transference of the sperm mass to the female in a venter to venter copulation. The discovery of spermatophores of *Necturus*, deposited under natural conditions and without stimulation, will determine whether or not those described above are typical of the species.

Single spermatophores vary in length from 10 to 12 mm. and in diameter, across the widest part of the apical portion, from 6 to 8 mm.

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Notes on the Silvery Footless Lizard, *Anniella pulchra*

By L. M. Klauber

In a recent paper on *Anniella pulchra* (Copeia, 1931, No. 3: 105-106) Dr. Chas. E. Burt reaches the conclusion, based on field data from Van Denburgh, Bogert, and the present writer, and from laboratory observations on a coastal specimen, that this lizard prefers a moist to a dry, sandy habitat.

I had previously advised Dr. Burt that I had collected this species only as far east as Jacumba, the approximate eastern limit of the range of a number of Upper Sonoran reptile forms. Mr. Frank Stephens has written to remind me that he had collected specimens of this lizard at La Puerta, in eastern San Diego County, these having been reported as long ago as 1917 by Grinnell and Camp. Specimens taken by Stephens are in the collections of the Museum of Vertebrate Zoology and the San Diego Society of Natural History. Also, since I wrote Dr. Burt, the Zoological Society of San Diego has received, through the activities of a county road crew, a number of specimens from Sentenac Canyon, Yaqui Well, The Narrows, and the San Felipe Wash, all of which points are in eastern San Diego County on the edge of the desert, that is, at the base of the desert foothills. Thus, the presence of this lizard is definitely established in desert situations where such typically Lower Sonoran forms as *Dipsosaurus dorsalis dorsalis, Sonora occipitalis,* and *Crotalus cerastes* are met. Here the rainfall probably averages below three inches per annum and the summer temperatures are extremely high. Although most of these desert specimens were collected in February, some were taken in July and August.

Thus, the theory that this species is restricted to a moderately moist area is hardly tenable. It would be interesting to experiment with some of these desert individuals to determine if they, likewise, prefer moist sand to dry, as did Dr. Burt's coastal specimen.

While my field experience leads me to believe that *Anniella* prefers a sandy to a rocky habitat, and is most plentiful along the coast, it is occasionally found in dense soil or amongst rocks. I have usually collected specimens under stones, or burlap sacks or other debris, but most of the specimens brought to the Zoological Society are found in the course of digging excavations. *Anniella* differs from *Leptotyphlops humilis humilis* in that the latter evidently prefers rocky situations. Dead specimens of the worm snake are occasionally found crushed on the road; I do not recall finding an *Anniella* in this condition, and in view of the fact that the legless lizards are much more common than the worm snakes, they must travel about less above ground. This is rather unexpected in view of the rudimentary eye of the snake as compared with that of the lizard.

I find the desert specimens of *Anniella* to be lighter in color than those from the coastal side of the mountains, but the difference is not sufficiently marked to permit their ready segregation in a mixed lot. *Anniella pulchra* is quite variable in pattern and color. The conspicuous element of

the pattern comprises a dark brown, mid-dorsal, longitudinal line, with a dorsolateral line on either side on the fifth to seventh row from the center; but other rows may be dark, or with dark scale edges, so that the pattern is not uniform. This is especially true posteriorly. Also, although the dorsal ground color is usually silvery or cream (in life), it may be so deeply suffused with drab or lavender, either on the back, the sides, or both, as to obscure the longitudinal lines. The color below is lemon yellow.

The tail seems to be seldom complete; apparently only a short cone is regenerated, and this is black. The tail proportion varies from 0.38 to 0.40 of the body length when complete. The maximum length reached in the San Diego territory is about 250 mm., of which 100 mm. is tail. The body diameter immediately behind the head, where it is greatest, is 6 mm. in the largest specimens.

A specimen collected August 31, 1926 (body length 131 mm.), contained two apparently fully developed embryos 69 and 66 mm. long. They are light colored with normal longitudinal lines clearly defined. They are folded three times in the egg membrane.

The range of *Anniella pulchra* is the coastal area of the Californias from Contra Costa County, California, southward to the San Pedro Mártir Mountains of Lower California, excluding the shore line from Monterey to San Luis Obispo (the habitat of *Anniella nigra*). The easterly boundary follows the westerly slope of the Sierras in the San Joaquin Valley, and the edge of the desert in southern and Lower California.

The localities known to me are the following:

Contra Costa County.
Monterey County: San Ardo.
San Benito County: Bear Valley.
San Luis Obispo County: Carrizo Plain (southeast of Simmler).
Santa Barbara County: Santa Maria.
Fresno County: Fresno.
Tulare County: Giant Forest (Sequoia National Park, 6400 ft.), California Hot Springs, Kaweah.
Kern County: between Oil City and Poso Creek, San Emigdio Mountains.
Los Angeles County: Redondo, Claremont, La Cañada (near Pasadena), Tujunga, La Crescenta, Griffith Park, Glendale, Gardena, 2 mi. south of Lankershim.
San Bernardino County: San Bernardino.
Riverside County: San Jacinto, Banning.
Orange County: Laguna Beach.
San Diego County: Coastal area—Leucadia (=South Coast Park), Encinitas, Rancho Santa Fe, Linda Vista, La Jolla, Pacific Beach, Mission Beach, Ocean Beach, Point Loma, San Diego, Coronado, Silver Strand, Paradise Valley, National City, Nestor, Monument 258, San Ysidro.
Inland valleys and mesas area—Moosa, Twin Oaks, Crescent Valley, El Cajon, La Mesa, El Monte, Spring Valley.
Foothills, western slope—Rincon, Ramona, Alpine, Descanso, Japatul, Twin Falls, Glen Oaks, Pine Valley, La Posta, Live Oak Springs, Hipass.
Mountain—Culp Valley, Julian.
Desert foothills—Yaqui Well, Sentenac Canyon, San Felipe Wash, The Narrows, La Puerta, Jacumba.
Lower California: San Salado Canyon, San José, San Telmo, San Quintín, Los Coronados Islands (North, East and South islands), North Todos Santos Island, San Gerónimo Island.

Several of the new central California records are published through the courtesy of the California Academy of Sciences.

I have examined the specimens in the collection of the San Diego Society of Natural History from Morro Bay, San Luis Obispo County, California, which were considered *nigra-pulchra* intergrades by Grinnell and Camp (1917). Two at least are adults (see Van Denburgh, 1922:470), but their condition is now such that no conclusions can be drawn as to their affinities. Mr. J. R. Slevin advises that the young of *Aniella nigra* closely resembles adult *A. pulchra*. Further information as to the possible subspecific relationship between *pulchra* and *nigra* must await new material from this area. By the opening of the new highway now under construction along the coast from San Simeon to Carmel our knowledge of the range of *A. nigra* should be greatly extended.

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ZOOLOGICAL SOCIETY OF SAN DIEGO, SAN DIEGO, CALIFORNIA.

Stomach Contents of Some American Coral Snakes, with the Description of a New Species of *Geophis*

By KARL PATTERSON SCHMIDT

THE predilection for snakes as food exhibited by coral snakes of the genus *Micrurus* is well known. This food habit has repeatedly been brought to the attention of herpetologists by the description of new snakes and other subterranean or secretive creatures from this source, such as the ground snake, *Storeria victa* Hay, based on a specimen from the stomach of a Florida coral snake (*Micrurus f. fulvius*), and the caecilian *Caecilia intermedia* Boulenger, a specimen of which was obtained from the stomach of a *Ninia atrata*, which in turn was contained in a *Micrurus corallinus* from Colombia. Vorhies (1929:98) has recently shown that the Arizona coral snake *Micruroides euryxanthus* (Kennicott), closely allied to *Micrurus*, probably feeds primarily on snakes.

In the course of a taxonomic study of the genus *Micrurus*, the stomachs of about 500 specimens have been examined; and although only 29 of these contain recognizable food remains, even this small series includes a

perfect specimen of the rare and remarkable typhlopid *Anomalepis mexicanus* and the type of a well marked new species of burrowing snakes of the genus *Geophis*.

The present paper lists the stomach contents of these snakes and describes the new *Geophis dunni*.

1. *Micrurus fulvius* (Linné)

U. S. N. M.	57727:	Gainesville, Florida—Tail of *Ophisaurus ventralis*.
	4804:	New Orleans, Louisiana—Tail of *Leiolopisma laterale*.
	44517:	Fort Worth, Florida—Tail of *Opheodrys aestivus*.
	17026:	Cameron Co., Texas—Tail of *O. aestivus*.
	56613:	McLennon Co., Texas—*Potamophis striatulus*.
	32761:	Kerrville, Texas—Tail of *Virginia valeriae elegans*.
F. M. N. H.	7777:	Gayle, Louisiana—Tail of *V. v. elegans*.
M. C. Z.	174:	South Carolina—Tail of *V. v. valeriae*.
U. S. N. M.	28908:	Lemon City, Florida—Tail of *Diadophis punctatus punctatus*.
	30949:	Lemon City, Florida—Tail of *D. p. punctatus*.
	4804:	New Orleans, Louisiana—Tail of *D. p. strictogenys, D. p. strictogenys, Storeria dekayi*, tail of *S. dekayi*.
Univ. Mich.	43930:	Texas—Tail of snake (unidentified).

2. *Micrurus nigrocinctus nigrocinctus* (Girard)

M. C. Z.	18843:	Corozal, Panama—Tail of Caecilian.
	5486:	Polvon, Nicaragua—*Ctenosaura completa*, juv.
	20577:	Ft. Davis, Canal Zone—Tail of Typhlopid.
F. M. N. H.	6117:	Frijoles, Canal Zone—*Anomalepis mexicanus*.
M. C. Z.	22030:	Guaymas District, Honduras—*Ninia atrata sebae*.
	20241:	Tela, Honduras—*N. a. sebae*.
	22136:	Finca Cipres, Guatemala—*N. a. sebae*.
	21782:	Progreso District, Honduras—Tail of snake (unidentified).
	19333:	Coen Dispensary, Costa Rica—Tail of *Coniophanes* sp.
	17087:	Matagalpa, Nicaragua—*Geophis dunni*, sp. nov.

3. *Micrurus corallinus riisei* (Jan)

F. M. N. H.	2587:	Orope, Venezuela—*Synbranchus marmoratus*.
A. N. S. P.	6795:	Venezuela—*Scolecosaurus cuvieri*.

4. *Micrurus elegans* (Jan)

A. M. N. H.	19720:	Mexico—*Geophis semidoliatus*.

5. *Micrurus mipartitus* (Jan)

A. M. N. H.	13563:	Venezuela—Tail of snake (unidentified.

Summary of Food Species

Fishes, one specimen, one species: *Synbranchus marmoratus* Bloch.

Caecilians, one specimen, one species: unidentified, probably *Herpele ochrocephala* (Cope).

Lizards, four specimens, four species: *Ctenosaura completa* Bocourt; *Ophisaurus ventralis* (Linné); *Scolecosaurus cuvieri* (Fitzinger); *Leiolopisma laterale* (Say).

Snakes, twenty-three specimens, sixteen species: *Anomalepis mexicanus* Jan, 1; *Helminthophis* sp., 1; *Ninia atrata sebae* (Duméril and Bibron), 3; *Potamophis striatulus* (Linné), 1; *Storeria dekayi* (Holbrook), 2; *Virginia valeriae valeriae* (Baird and Girard), 1; *Virginia v. elegans* (Ken-

nicott), 2; *Diadophis punctatus punctatus* (Linné), 2; *Diadophis p. stricto-genys* Cope, 2; *Geophis semidoliatus* (Duméril and Bibron), 1; *Geophis dunni,* sp. nov., 1; *Opheodrys aestivus* (Linné), 2; *Coniophanes* sp., 1; species undetermined, 3.

The inclusion of an eel, *Synbranchus,* in the diet of *Micrurus corallinus* is remarkable, but probably indicates an invasion of semi-terrestrial habitat conditions by the eel rather than entry into water on the part of the coral snake. Exclusive of *Synbranchus,* the eighteen identifiable species in these stomach contents include six species which are genuine burrowers (*Herpele, Ophisaurus, Anomalepis, Helminthophis,* and two of *Geophis*); ten which are distinctly secretive, usually found by collectors only under logs or bark or other objects (*Scolecosaurus, Leiolopisma, Ninia, Potamophis, Virginia, Diadophis,* and *Coniophanes*); and two (*Ctenosaura* and *Opheodrys*) which are active, surface dwelling forms.

Geophis **dunni,**[1] sp. nov.

Type.—M. C. Z. No. 31870. Matagalpa, Nicaragua, adult female, from stomach of *Micrurus nigrocinctus nigrocinctus.*

Range.—Known only from the type locality.

Diagnosis.—A *Geophis* with two pairs of chin shields; 5th upper labials meeting the parietals; dorsal scales smooth on the nape, elsewhere keeled, in 17 rows; ventrals 140, anal entire, subcaudals 36; back with dark cross-bands, belly uniform, light; apparently allied to *G. semidoliatus* in coloration and to *G. chalybaeus* in scale characters.

Description of type.—Body cylindrical, moderately stout, tail short, head pointed, with projecting snout, not at all wider than the body.

Portion of rostral visible from above about equal to the internasal suture; internasals small; prefrontals large, broadly entering the eye; frontal nearly as wide as long; supraocular small; parietals large, their suture nearly as long as the frontal; nasal divided; loreal broadly entering the eye; no preocular; one postocular; six upper labials, the fifth broadly in contact with the parietal; a single temporal between the sixth labial and the parietal.

Scales keeled with the exception of those on the nape, in 17 rows throughout; ventrals 140; anal entire; 36 subcaudals.

Pale yellow above, the scales with brownish outlines, with 24 dark brown cross-bands which extend to the 1st scale row but do not reach the ventrals; venter immaculate, pale yellowish, except for the tip of the lower jaw; crossbands on tail broken up into spots toward the tip; 1st cross-band on the neck wider than the succeeding ones; head black to the middle of the parietals, then brown, the post-parietal scales brownish yellow.

Total length 367 mm., tail 57 mm.

Remarks.—The coloration of this species is most like that of *Geophis semidoliatus* of Mexico, which has smooth scales, while the keeled scales and the scale characters in general of *dunni* recall *G. chalybaeus* of western Mexico and Guatemala. The maxillary teeth number about 12, decreasing in length both anteriorly and posteriorly.

[1] Named for Dr. Emmett Reid Dunn of Haverford College in allusion to his important contributions to our knowledge of this group of snakes.

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The Western Limit of Range for *Chrysemys picta bellii*

By TRACY I. STORER

ANCIENT errors in statements of animal distribution die slowly if at all! The status of the bell painted turtle in the Pacific northwest is a case in point. *Emys Bellii* was described by Gray in 1831, without indication of type locality. In 1837 Harlan described an *Emys oregonensis,* collected by Nuttall in "Oregon," in ponds near the Columbia River. Agassiz (1857, 1: 440) had "great doubts respecting the accuracy of the statements of Nuttall, that this species was found in Oregon. It has never been seen in that territory by the many expeditions which have explored it since Nuttall...." In Nuttall's time Oregon included all the region to the north which is now within the state of Washington. Cooper (1860, 2: 292) said of *Actinemys* [=*Clemmys*] *marmorata,* "This, the only turtle yet known from west of the Rocky mountains, is common in freshwater ponds and rivers west of the Cascade mountains, though less so in the Columbia than in the warmer ponds . . . [and that it was] found in pools about Fort Steilacoom...." He made no mention of the painted turtle although he worked in the territory east of the Cascades (see Taylor, 1919: 73).

Specimens of *bellii* were collected and deposited in the British Museum by G. M. Dawson and J. K. Lord of the British North America Boundary Commission. Lord (1866, 2: 301) says, "I obtained these turtles at Walla-Walla, in the month of June...I have seen them in nearly every lake and pool east and west of the Cascades. They are also common on Vancouver Island." Lord's statement was entered under *Actinemys marmorata.* But his specimens were *Chrysemys picta bellii.* His observations (1866, 1: 100-102) are descriptive of *bellii* rather than *marginata.* His statement of range was not fortified by specimens from west of the Cascades so far as I can ascertain. Gray, the describer of *bellii,* correctly places Lord's reference under that name in his "Hand-list" (1873: 33) and Boulenger (1889: 74) does likewise. The Dawson specimen bore only the designation "British Columbia" while Lord's specimens (at least 3) were listed as from "British Columbia, Walla Walla."

Kermode (1909: 74) lists *marmorata* from the mainland of British

Columbia, but makes no mention of the latter from Vancouver Island nor of the painted turtle in any connection.

Yarrow (1883:34) listed a specimen of *Chrysemys belli* collected by Bendire in 1881 at Fort Walla Walla, Washington Territory. Blanchard (1921:6) reported specimens from Springdale, Stevens County, Washington. Recently (Storer, 1930:429) I reported specimens from the vicinity of Walla Walla. Three were taken at Lowden (between Walla Walla and Wallula), July, 1926, and one on the government reservation at Walla Walla, May 28, 1928. All were obtained through the kindly offices of Mr. Philip H. Pope. They agree with the characterization of the subspecies *bellii* as given by Bishop and Schmidt (1931).

Recent correspondence with Mr. F. S. Hall, of the University of Washington, brought word that turtles are rare in western Washington. *C. p. bellii* has been found in Moses Lake, Douglas County, "and other lakes in eastern Washington." Mr. W. A. Newcombe writes that the Provincial Museum at Victoria has no specimens of turtles from Vancouver Island and little information other than that native turtles are reported near Alberni.

Van Denburgh (1922:984) states that he had twice seen specimens of *bellii* in markets in San Francisco but that their source was in doubt. Since turtles are shipped from the eastern states by pet dealers, and possibly also for table or laboratory use, this or other species may appear in the markets of the west, and might even escape or be "planted" by human agency, as has occurred with two or more other species in California.

Thacker (1924) states that *bellii* is plentiful in the Okanagan Valley from the International Boundary north to Okanagan Lake; he likewise was in doubt as to the species present on Vancouver Island, but mentions the possibility of an introduced form being present on the island.

There is thus no definite basis for ascribing *Chrysemys picta bellii* to the region west of the Cascade Mountains. It is a species of the interior, definitely recorded from the Mississippi drainage, Colorado, (New Mexico?), and eastern Washington. Like many other vertebrates it evidently circles the northern margin of the Great Basin to reach its limit of range east of the Cascade system. Specimens from the Rocky Mountain Plateau and northern Great Basin are much to be desired.

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On a New Anolis from Western Mexico

By THOMAS BARBOUR

ON a day last spring, April 10, 1931, while driving with Mrs. Barbour and my daughter, Mary, to a finca some miles north of Mazatlan, we stopped in a dusty lane to let a herd of calves pass by. The herd was followed by a barefooted Indian who trudged wearily behind them through the deep dust. He carried in his hand a long lashed whip and from time to time he snapped it viciously and in so doing killed the lizards on rocks or fence posts by his way with most extraordinary skill. We watched him some time quite fascinated. I asked him what on earth he was pocketing these lizards for. He looked at me with surprise and then added, "I am taking them home to feed my cats." I bought what he had for a few cents. It was obvious that he felt quite certain that he had been dealing with a person of unsound mind as he walked on looking at the coins, for it surely had never occurred to him that such small game had a cash value.

Among these lizards one, I feel quite certain, is unknown. With Dr. Stejneger's and Miss Cochran's aid I have compared it with the considerable material in Washington and I can find nothing like it. The same applies to the material in this Museum. I am defining the species to perpetuate the name of the Yacht *Utowana* which, under the aegis of her kindly own-

er, Allison V. Armour, has for years been carrying naturalists hither and yon about the world to further research in many fields.

Anolis ***utowanae,*** sp. nov.

Type.—Mus. Comp. Zool. No. 31,035, female. Taken about ten miles north of Mazatlan, Sinaloa, Mexico, April 10, 1931.

Diagnosis.—Apparently nearest *A. baccatus* Bocourt, of which I have photographs of the type in the Paris Museum. It differs in having three, four or five scales between the occipital plate and the supraocular semicircles, considerably larger scales upon the snout and what are no doubt characteristic markings on the labial scales, which do not appear in the other species. It is one of the rather few Mexican species with flat, pavement-like, ventral scales.

Description.—Top of head without well defined frontal ridges; head scales some rough, some keeled; 7 scales between the nostrils; supraocular semicircles composed of large, rather flat scales, separated from each other by a single row of small scales; occipital smaller than ear opening, separated from the supraocular semicircles by 3 or 4 rows of scales; supraocular disk consisting of one large, four somewhat smaller, and 5 or 4 scales distinctly smaller still, all faintly keeled; canthus rostralis consisting of 5 sharply keeled scales, the first very small, the 4th largest, behind these a single long, narrow superciliary, reaching to above the center of the eye and separated from the supraocular disk by 3 or 4 rows of small granules; loreal rows 3 only, the snout being rather depressed and flattened; subocular semicircle composed of large, flat scales, broadly in contact with the supralabials; 8 supralabials, suture between sixth and seventh being under the center of the eye; temporals very finely granular, bordered above by the curved supratemporal line of two rows of slightly enlarged granules, this line being the posterior continuation of the subocular semicircles; dorsals granular, inclined to be sharply conical, 6 or 7 middorsal rows very slightly enlarged and distinctly keeled, the keels forming more or less continuous lines; ventral scales smooth, roughly hexagonal, forming a pavement-like pattern anteriorly but inclined to be slightly imbricate on the posterior part of the belly; scales on the throat round and smooth, anteriorly elongate and smooth; forelegs, above, with about 10 rows of enlarged, slightly keeled scales; scales on anterior aspect of femur much enlarged with a sharply defined but low keel; digits rather slender with moderately developed expansions; tail slightly compressed with distinct verticils, comprised of about 8 series of sharply keeled scales; dorsal caudal scales slightly spinose; several series of enlarged, flat subcaudal scales, distinctly broader than long.

Color in alcohol.—Dark iron gray with irregular darker crossbars; occipital region dark, a darker band across the nape, one between the forelegs, two on the body and one across sacral region; tail irregularly crossbarred, lower surfaces white; lower aspects of limbs and base of tail speckled with dark brown; infralabials with a series of 7 dark spots and a row of dark spots along the outer series of gular scales; 4 dark longitudinal mid-gular stripes.

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASSACHUSETTS.

Notes on the Food Habits of Three Species of Lizards from Utah

By Lowell A. Woodbury

THE following notes were made on the stomach contents of lizards in the collection of the University of Utah. For permission to examine these specimens, I am indebted to Dr. R. V. Chamberlain of this institution. He has also very kindly examined the manuscript of this paper. To Dr. A. M. Woodbury, also of this institution, I wish to express my thanks for his suggestion and supervision of this study.

1. *Sceloporus graciosus graciosus* (Baird and Girard)

The 53 lizards from which the following study of this species was made were collected in different parts of Utah at various times of the year. They were taken mostly from regions bearing vegetation indicative of the Upper Sonoran or Transition life zones.

TABLE 1

Stomach contents of 53 specimens of *Sceloporus graciosus graciosus* (Baird and Girard)

Group	Larvae	Pupae	Adults	Total	Volume	Per cent of Total Vol.
Sand				x	A few grains	
Green plant tissue				x	0.2 ml.	2.81
Nematoda			13	13	1.0	13.49
Acarina			25	25		
Araneina			22	22		
Unidentified forms	8		36	44		
Fragments				x	1.0	13.49
Orthoptera	13		5	18	0.6	8.18
Neuroptera			2	2		
Hemiptera	4		34	38		
Homoptera	33		88	121		
Coleoptera	6	1	108	115	1.7	22.49
Lepidoptera	46		1	47	1.8	23.18
Diptera			104	104	0.6	8.18
Hymenoptera			218	218	0.6	8.18
Totals	110	1	656	767	7.5	100.00

These lizards appear to be voracious feeders, as in only a few cases were the stomachs empty and frequently they were filled to capacity. The food consisted almost entirely of terrestrial arthropods. A small amount (2.8 per cent) of green plant tissue, mostly leaves, was present. This may have been accidentally ingested, as in almost every stomach in which green plant tissue was found, leaf eating lepidopterous larvae accompanied

[1] Contribution from the Zoological Laboratory of the University of Utah, No. 54.

it. The lizard appears to feed on active forms such as beetles and ants. Coleoptera hold first place in numbers but in bulk lepidopterous forms (mostly caterpillars) take the lead by a narrow margin with slightly more than 23 per cent of the volume as against 22.5 per cent for the beetles. Hymenoptera and Diptera follow next with about 8 per cent each. Other forms occur in lesser amounts.

The accompanying table shows the result of the examination (Table 1).

2. *Sceloporus elongatus* Stejneger

The 31 lizards on whose stomach contents this note is based were collected in southeastern Utah along each side of the Colorado River in Wayne, San Juan, Emery and Grand counties, by a zoological expedition of the University of Utah, April 13-22, 1928; and in southwestern Utah at Zion National Park, during the summer of 1927. Mr. A. M. Woodbury was the principal collector.

TABLE 2

Stomach contents of 31 specimens of *Sceloporus elongatus* Stejneger

Group	Larvae	Adults	Total	Volume	Per cent of Total Vol.
Nematoda		51	51	0.1 ml.	1.63
Araneina		9	9		
Unidentified insects	13	5	18	0.8	13.10
Misc. and insect frag.	x	x		1.6	26.20
Orthoptera	2		2		
Neuroptera	1	2	3		
Coreidae[2]	8	7	15		
Pentatomidae[3]		4	4		
Other Hemiptera	4	9	13	1.0	16.41
Aphididae		6	6		
Cicadellidae		3	3		
Other Homoptera		2	2		
Scarabeidae		11	11		
Rhynchophora		2	2	0.7	11.50
Other Coleoptera	4	34	38		
Lepidoptera	6	7	13	0.5	8.20
Isoptera		10	10		
Formicidae		84	84		
Apoidea		16	16		
Ichneumonoidea		10	10	1.4	22.96
Other Hymenoptera		6	6		
Diptera		9	9		
Totals	38	287	325	6.1	100.00

The country in which they were taken is a semi-desert region of the bad land type bearing vegetation mostly indicative of the Upper Sonoran life zone.

This lizard appears to feed principally upon terrestrial arthropods. In a few stomachs very small particles of plant tissue and small quantities of sand were present, probably accidentally ingested. It obtains food principally by stalking its prey but the presence in some of the stomachs of subterrestrial larvae indicate that it does some digging for its food.

[2] Chelinidea vittiger.
[3] 1 Brochymena sulcata.

This species is primarily insectivorous, taking practically any insect available not too large to be handled. It appears to be fond of ants as it devoured more of these insects than of any other group. The examination of the stomachs showed more adults than larvae both in numbers and volume indicating, perhaps, a preference for the more rapidly moving type of insects.

Table 2 shows the results of the examination of this species.

3. *Uta stansburiana stansburiana* (Baird and Girard)

The 46 lizards from which this study is made were collected along each side of the Colorado River in Emery, Wayne, Grand and San Juan counties, by a zoological expedition of the University of Utah, April 13-22, 1928. Mr. A. M. Woodbury was the principal collector.

They were taken in a semi-desert region of the bad land type, bearing vegetation to match, mostly indicative of the Upper Sonoran life zone.

TABLE 3

Stomach contents of 46 specimens of *Uta stansburiana stansburiana* (Baird and Girard)

Group	Larvae	Adults	Total	Volume	Per cent of Total Vol.
Acarina		30	30	0.1 ml.	1.82
Araneina		27	27		
Unidentified insect fragments	x	x	x	3.7	67.28
Acrididae	5	1	6		
Miridae		1	1		
Lygaeidae		8	8		
Miscellaneous Hemiptera	4	27	31	0.1	1.82
Cicadellidae		13	13		
Aphididae		6	6		
Carabidae		4	4		
Scarabeidae		7	7		
Chrysomelidae		17	17	0.15	2.72
Rhyncophora		9	9		
Miscellaneous Coleoptera		31	31		
Lepidoptera	46	3	49	1.15	20.92
Diptera		13	13	0.15	2.72
Ichneumonoidea		14	14		
Formicidae		38	38	0.15	2.72
Apoidea		12	12		
Miscellaneous Hymenoptera		12	12		
Totals	63	265	328	5.50	100.00

The lizards were quite active and plentiful at this time of year. The stomach contents consisted almost wholly of terrestrial arthropods, the only other material being a few grains of sand, probably accidentally ingested. No plant tissues were discernible. This species appears to feed principally on the actively moving types of insects which it obtains largely by stalking, but it does not scorn a fat, juicy, slow-moving larva on occasion.

In numbers the adults in the stomach contents outnumber the larvae 265 to 63, but in bulk lepidopterous larvae form 18 per cent of the total volume, whereas the identified adults of all forms comprise only 15 per cent. Undetermined insect fragments form the remainder.

The evidence appears to indicate that this species is primarily insectivorous and will take almost any kind of insect that is not too large to be handled. Insects of the orders Lepidoptera, Coleoptera, Diptera and Hymenoptera comprise the bulk of the identified material, while those of the orders Hemiptera, Homoptera, Orthoptera, and Arachnida, occur in lesser amounts. The arachnids consist principally of spiders which appear to be taken readily, and parasitic mites which seem to have been ingested with the insects.

Table 3 gives a summary of the stomach contents of this species.

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A Review of the Freshwater Cottoid Fishes of the Pacific Slope of Asia

By Leo S. Berg

IN this paper only the bullheads of the Pacific slope of the mainland of Asia are mentioned, the freshwater bullheads of Japan not being known to me from personal examination. The numbers refer to the collections of the Museum of Zoology, Academy of Sciences, Leningrad. For further details, see my "Fresh water fishes of Russia," third edition, in press.

1a. Head without crests.
  2a. Vomerine teeth well developed.
    3a. No palatine teeth.
      4a. Innermost ray of *V* not more than 40 per cent of the longest ray. Lateral line incomplete, running above the middle of sides. *Cottus poecilopus*
      4b. Innermost ray of *V* more than 40 per cent of the longest ray. Lateral line complete, running along the middle of body..*C. amblystomopsis.*
    3b. Palatine bones each with a conspicuous band of teeth.....*C. czerskii.*
  2b. Teeth on vomer feeble or wholly absent.....*C. kaganowskii.*
1b. Head with crests.
  3c. No palatine teeth.....*Mesocottus haitej.*
  3d. Palatine teeth present.....*Trachidermus fasciatus.*

1. *Cottus poecilopus* Heckel, 1840

No palatine teeth. D. VIII-IX, 17-19; A. 13-15; V. 1, 4, rarely 1, 3; the innermost ray of ventrals not more than 40 per cent of the length of the longest ray. Ventrals with dark cross stripes. Length 130 mm. Southeastern Norway, western Jutland, Baltic sea drainage, Danube and Dniestr rivers, Polar Sea drainage from the Ob to the Kolyma, Amur River, eastern slope of Sikhota-Alin Range, Tumen-ula, Yalu, Corea.[1]

2. *Cottus minutus* Pallas, 1811

Known only from a dried specimen described by Pallas from Tauisk, coast of Okhotsk Sea. D. VII, 18; A. 13, V. 2. Ventrals with dusky rings. Length 3 inches. May prove to be identical with *C. poecilopus* (as supposed by Gratzianow, 1907).

3. *Cottus kaganowskii* Berg, new species

Figures 1 and 2

D. VII-IX, 16-18; A. 11-13; V. I, 4 (in one specimen I, 3). No teeth on palatines. Teeth on vomer very feeble or, in non-adults, absent. Lateral line running above the middle of body, reaching usually to below seventh or eighth ray of second dorsal, sometimes to the eleventh or twelfth ray. Body naked, except under pectorals, where more or less densely scattered prickles are present. Preopercle with a single spine. Anterior nasal openings in form of short tubes. Maxillary not reaching to below middle of

[1] C. reini Hilgendorf, 1879, from Japan, seems to be allied to C. poecilopus.

eye. Fifth ray of ventrals very feeble. Small dark spots on dorsals, pectorals and caudal sides with irregular dark spots.

MEASUREMENTS OF COTTUS KAGANOWSKII IN MM.

Sex	Belaya R. ——	Belaya R. Male	Anadyr R. Male	Belaya R. Female
Total length	77	98	101	82
Length to base of caudal	62.5	82.5	84	68
Head	18.5	26.5	26	19.5
Eye	3.75	5.25	5.5	4
Interorbital space	2.75	3.75	4	2.5
Depth of body	14	16	16	12
Least depth of body	5.25	6.25	6	4.5
Length of caudal peduncle (to first rays of caudal)	8.5	12	12.5	10
Length of ventral fin	13	18.25	18	14.25
Distance, ventral to anal	16.5	25	27.5	23

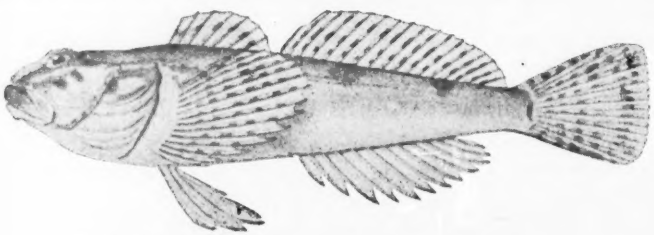

Fig. 1. *Cottus kaganowskii.* Belaya River., tributary to Anadyr River (No. 23140). Length, 77 mm.

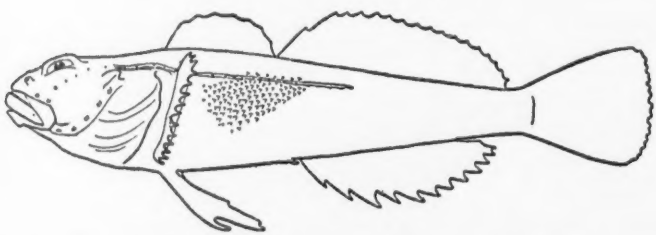

Fig. 2. *Cottus kaganowskii.* Same specimen. Prickles and lateral line below the pectoral fin are seen.

System of Anadyr River (northeastern Siberia), from the Belaya River to the mouth. Described from 49 specimens collected by A. G. Kaganowsky, ichthyologist at Fishery Institute Vladivostok: No. 23140 (Zoological Museum, Academy of Sciences), Belaya River at Sofron factory, October 10, 1928, total length 77 mm; No. 23141, Telegrafnaya River, tributary to Anadyr River, July 9, 1929, 64 mm; No. 23805, Anadyr River at Ust-Belaya, June 28, 1929, 23 specimens 43 to 98 mm; No. 23808, same locality, October 7, 1928, 1 specimen; No. 23809, same locality, June 25, 1929, 1 specimen, 72 mm; No. 23807, Anadyr Liman at Kedrovaya Kosh-

ka, July 13, 1929, 2 specimens, 27.5 to 48 mm; No. 23806, Anadyr River at Telegrafnaya spit, September 22, 1929, 20 specimens, 43 to 101 mm.

By the absence or feeble development of vomerine teeth *C. kaganowskii* is well distinguished from other Palearctic species of the genus *Cottus*. The North American *C. aleuticus* Gilbert 1893, distributed from Unalaska to Monterey, has vomerine teeth feebly developed, posterior nostrils tubular and lateral line complete or nearly so. In general aspect and fin formula *C. kaganowskii* somewhat resembles *C. knerii* Dybowski from Lake Baikal.

4. *Cottus amblystomopsis* Schmidt, 1905

Cottus amblystomopsis P. Schmidt, Pisces marium orientalium, 1904: 89, pl. 2, fig. 1-3 (Lutoga River, southern Sakhalin; No. 12763).

Cottus emeljanovi Lindberg, Mémoires Univ. Extr. Orient, Vladivostok, 8(2), 1927: 7, fig. (rivers Kopi and Botchi falling into Japan Sea below 48° N. Lat.; No. 21988—Botchi R.).

D. VIII (IX), 18-19; A. 14; P. 15-16; V. I, 4. No teeth on the palatines. Lateral line running above the middle of body; on the caudal peduncle it bends to the middle of body and reaches the base of caudal. Males with very long ventrals reaching beyond the origin of anal and provided with bony tubercles. Posterior nasal openings small. Skin on the upper side of head warty and wrinkly. Preopercle with two spines, which disappear in adults. Length 208 mm. Southern Sakhalin and opposite coast of mainland. In coloration and aspect much resembling *C. czerskii*.

T. Mori (Journ. Chosen Nat. Hist. Soc., 11, 1930: 10, fig.) describes from the middle course of the Tumen-ula River *C. hangiongensis* Mori; it is very near to *C. amblystomopsis*, but has more rays in second dorsal and anal: D. VIII, 21; A. 16; V. I, 4. Total length 150 mm.

5. *Cottus czerskii* Berg

Figures 3 and 4

Cottus (*Pegedictis*) *czerskii* Berg, Zapiski Soc. for study of Amur country, 12, 1913: 17, fig. (Sedanka River near Vladivostok).

Cottus (*Pegedictis*) *paltschevskii* Schmidt, Ann. Mus. Zool. Pétersburg, 20, 1915: 614 (River Sakhobé, tributary of Terney Bay, Japan Sea, Primorsk Prov.; No. 18959).

D. VIII-X, 19-22; A. 14-16; V. I, (3)4. A very conspicuous patch of teeth on each palatine. Otherwise near to *amblystomopsis*. In adult males ventral fins with tubercles. In large specimens a rudimentary fold across the isthmus. Total length 195 mm. Western coast of Japan Sea from Terney Bay to Tumen-ula River. Replaced in Hondo, Japan, by *C. kazika* Jordan and Starks 1904 (D. VIII, 14-16; A. 13-15; V. I, 4).

6. *Mesocottus haitej* (Dybowski), 1869.

Top and sides of head with crests. No palatine teeth. D. VIII-IX, 14-15; A. 10-12 (13); V. I, (3) 4. Total length 200 mm. Amur basin from the upper course to the mouth. Taken in northern Sakhalin by A. N. Derzhavin.

7. *Trachidermus fasciatus* Heckel

Trachidermus fasciatus Heckel, Ann. Wien. Mus., 2, 1840: 160, pl. 9, fig. 1, 2 ("Philippines," probably=China).

Trachidermus ansatus (Richardson 1843) Jordan and Starks, Proc. U. S. Nat. Mus., 27, 1904: 262, fig. 14 (Kurume, Kyûshû).

Trachidermus fasciatus Jordan and Starks, *ibidem*, 28, 1905: 206 (Chemulpo, Corea); ibidem, 31, 1906: 522 (Port Arthur).—Mori, Journ. Chosen Nat. Hist. Soc., 6, 1928: 19 (Yalu River).—Jordan and Hubbs, Mem. Carnegie Mus., 10(2), 1925: 277 (Fukuoka, Kyûshû; Soochow, China).

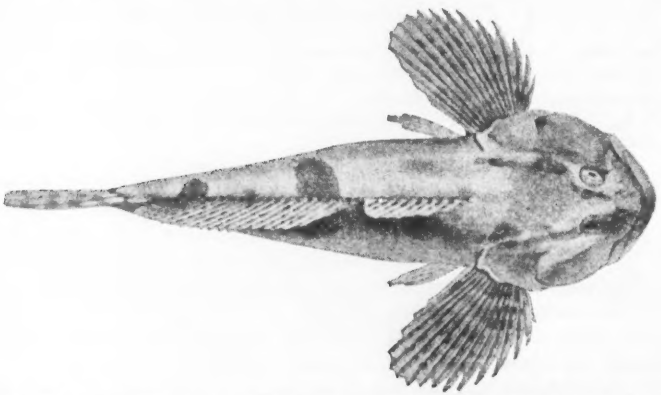

Fig. 3. *Cottus czerskii.* Sakhobé River, Terney Bay (No. 18959). Length, 196 mm.

Fig. 4. Ventral fin of *Cottus czerskii* Berg, from above. Natural size.

Allied to *Mesocottus haitej,* but with teeth on palatines. The relation between this species and *M. haitej* is the same as between *Cottus czerskii* and *C. amblystomopsis.* D. VIII, 18-19; A. (15) 17-18; V. I, 4. Corea (Yalu River, Chemulpo); Shan-hai-kuan, Port Arthur; lower course of Yangtse River, Ning-po; Japan (Kyûshû); Philippines?

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The Problem of Self-Fertilization in Teratologically Hermaphroditic Fishes

By H. Herbert Johnson

THE recent case of an hermaphroditic striped bass, *Roccus saxatilis*, reported by Schultz (1931) is of particular interest, less because of the simultaneous presence of male and female gonadial tissue (which has been reported frequently in the Serranidae), than because of a possibility which he did not state, namely that self-fertilization might have taken place in this specimen. The single ovary and the testis were unilateral and contained well-developed ova and sperm respectively. Unfortunately the ducts are not described, but according to Schultz, "Undoubtedly this fish would have spawned both sexual products." The mere occurrence of hermaphroditism in fishes is no longer very novel. Extensive bibliographies on this subject are given by Gemmill (1912) and by Dean (1923). The latter recognizes two groups of hermaphroditic fishes: *normal* (in which the condition is invariable, or at least occurs in the great majority of individuals), and *teratological* (in which hermaphroditism is sporadic, or, indeed, very exceptional). Under Teleostei twenty species are listed as of the latter type; certain ones, such as the carp, cod, herring and perch, are reported by several authors. Recent cases of interest were reported in the rainbow trout (Mršič, 1923; DeBeer, 1924) and in the silver salmon, *Oncorhynchus kisutch* (Crawford, 1927).

Considering the large number of hermaphroditic individuals which occur sporadically, it seems odd that the possibilty of self-fertilization in the teratological specimens has received so little attention.[1] Such an event is a matter of considerable interest to the biologist on account of its rarity in animals generally, and because of the problems of sex determination and inheritance which it involves. Recent authors seem to accept without question the statement that certain species of sea perch, *Serranus*, are constantly hermaphroditic and self-fertilizing; this conclusion appears to rest upon the laboratory observations of Dufossé (1856), partly corroborated, so far as the internal anatomy is concerned, by Brock (1878). Brock's findings were also widely accepted by authors, although certain points were called into question by Stéphan (1901). Aside from *Serranus*, most fish hermaphrodites, both normal and otherwise, are described as being protandrous in nature (see especially Stéphan, 1901), hence self-fertilization is impossible, since sperm and ova do not ripen simultaneously.

The only actual case of teratological self-fertilization that has come to my attention is that reported briefly by Stewart (1894a) in a specimen of *Salmo fario*. On two occasions ripe ova were caused to be extruded from this trout by artificial abdominal pressure. These eggs were kept isolated, and from them normal and healthy young were reared. They were assumed to have been self-fertilized. Dissection of the fish which

[1] Since this paper went to press, C. L. Turner has described an ovo-testis in Perca flavescens. From its structure, he deducted the possibility of functional hermaphroditism (Science, 74, 1931: 370-371).

yielded these eggs revealed ovarian and testicular tissue with connecting ducts. Although Stewart merely made the dissection, the history of the specimen as reported to him probably is well founded.

For self-fertilization to take place, at least three conditions are essential:—1, simultaneous maturation of ova and sperm in the one individual; 2, a complete system of gonadial ducts which will permit union of the ripe germ cells; 3, the sperm and ova must be of a physiological constitution which permits of mutual activation resulting in fertilization. In Schultz's bass, at least the first of these conditions seems to be realized. Several of the other cases described appear to afford a distinct possibility of self-fertilization entirely overlooked by the various authors concerned. Stewart (1894 b) found in a mackerel two testes and two ovaries. The figures indicate that these four organs were united posteriorly by a common duct; "both ova and spermatozoa were perfectly developed." Williamson (1906) found two hermaphroditic cod, *Gadus callarias,* in which the ducts were connected (quoted by Bishop, 1920). Bishop himself, in the white perch (*Morone americana*) found an ovary attached at the anterior end of each testis by a short duct. On one side the presence of eggs extending along the entire length of the testis indicated a connection between the ovarian duct and the vas deferens, but this was not surely determined. The remaining cases reviewed were, for the most part, not sufficiently worked out to establish the co-existence of the first two essential conditions mentioned above. However, it seems safe to conclude that a *mechanism* for possible self-fertilization exists in many cases of teratologically hermaphroditic fish.

The present writer is able to report one rather fragmentary observation on the common scup, *Stenotomus chrysops* (Sparidae), which seems to be of interest in connection with this problem, since it involves a phenomenon which seems easiest to explain on the basis of internal self-fertilization. While at the Marine Biological Laboratory, Woods Hole, Mass., in 1926, I had occasion to make a trip in the laboratory's collecting boat to the fish traps in Buzzard's Bay for the purpose of collecting eggs of the scup which were needed for a cytological study. As the nets were pulled and the living fish were dropped into the bottom of the boat, females were sorted out. It was necessary to work with speed. Each female was stripped into a dry finger-bowl, after which the bowls were stacked. Care was taken that each fish was stripped into a separate bowl, hence no mixture of sex products from different individuals could occur. Immediately after stripping, each fish was discarded as no longer of use, fresh ones being selected from the dip net as it was brought in. Upon stacking some of the finger-bowls, a peculiarity of one batch of eggs was noticed. Closer observation revealed the surprising fact that about fifteen of the eggs were in a fairly advanced state of embryological development. These were carefully segregated and later studied under the binocular microscope. Although the embryos were sightly variable in development, all showed well-formed optic vesicles and from five to twelve pairs of somites. Heart action was not observed, but the embryos, yolk balls and perivitelline spaces were clear. They were not so viable as embryos ob-

tained from eggs that were fertilized in the laboratory; some of them appeared defective. After a few had died, the entire lot was placed in preservative. The poor condition of the eggs may have been due to injury in the stripping process, or to the fact that the eggs remained dry for a short time and were subjected to a considerable rise in temperature during the trip back to the laboratory.

It is much to be regretted that in the haste and confusion of stripping while the nets were being pulled, the fish from which the embryos were obtained was discarded before the peculiarity was observed. Upon the suspicion that this fish was an hermaphrodite, the entire catch was held for further study. Examination of about one hundred and forty fish failed to reveal anything unusual that could be detected macroscopically. There can be no doubt, however, that the embryos were caused to be extruded by pressure upon the abdomen of a single *Stenotomus chrysops* which externally resembled a female and which was assumed to be such. In the absence of cytological study upon this fish, self-fertilization in this instance cannot be established as a certainty. However, it seems to the writer that the assumption of an anomalous hermaphroditic condition with a resulting internal self-fertilization is the most plausible explanation that can be devised for his case.

This conclusion is reached after careful consideration of several other possibilities. For example, in certain fishes, e.g. *Lebistes, Platypoecilus,* etc., an ovoviviparous condition results from biparental copulation. In certain other fishes which are egg-laying in habit, an act approaching copulation takes place. I have observed in *Brachydanio rerio* and *B. albolineatus* that the female never extrudes eggs during active courtship unless, or until, her cloacal opening actually comes in contact with that of the attendant male, whereupon a small stream of eggs is ejected. Fertilization results instantly. If the sperm were actually transferred into the female cloaca at this moment of contact, internal fertilization might result. However, this does not appear to me to represent more than a theoretical *tour de force*. No mechanism for such transfer of sperm with subsequent retention of eggs is observed in the scup.

Newman (1908) states that *Fundulus majalis* frequently eats its own eggs and passes them undigested through the alimentary tract, "but such eggs are always dead and opaque." Ryder (1885) described *Fundulus majalis* as a viviparous species because he had forced advanced embryos from the body by pressing upon the abdomen of the living fish. There is no statement as to the number of adult fish or of embryos examined, but the latter are figured in his plates. Newman (1909) suggests that Ryder may have forced the embryos from the alimentary canal instead of from the ovary. I am inclined to doubt that this explanation of Newman could be applied to the scup which I have described. In the first place the eggs, while rather poorly viable as I have indicated, were not dead and opaque. Again, if the female scup had swallowed her own eggs, it seems to me unlikely that these could develop so far as the ten somite stage while being exposed to the strong digestive fluids which fish are known to possess. It is conceivable that this scup had eaten previously

laid eggs which already had begun development, but if so, it would be expected that other fish in the same catch would have found similar fare. I have never obtained embryos in this fashion from any other scup. In the open bay it seems unlikely that only one of many scup would find and swallow several advanced embryos of about the same stage of development, but this possibility constitutes the only visible weak link in an otherwise perfect *a priori* case for self-fertilization. While I cannot prove that the embryos did not come out of the alimentary canal, it seems to me improbable that they did so. In this connection it should be recalled that the embryos from Stewart's trout were obtained likewise by abdominal pressure.

Newman's explanation is weakened further by the significant observations of Nordquist (1899), who found upon dissection that a few of several specimens of the sculpin, *Myoxocephalus* [*Cottus*] *scorpius,* contained *within the ovary* living embryos with pigmented eyes. Nordquist at first assumed internal fertilization by copulation in the sculpin, but this was subsequently disproved and, in a letter to Ehrenbaum the former announced that he had changed his view and now considered the internal embryos as exceptional. Gill (1905), who reviews this case in detail, with references and translations in English, concludes that in the sculpin "a legitimate inference . . . . seems to be that . . . . the sexes may come together and the ova are fertilized just before or during protrusion, but sometimes there may be some arrest or retardation in passage of the eggs and then there may be internal fertilization." I find Gill's explanation difficult to accept on account of the absence of copulatory mechanism. The explanation which I have offered for the scup could apply with equal justification to these exceptional sculpins, in which histological examination might have revealed the presence of testicular tissue, if such examination had been made.

Finally, it might be argued that the scup embryos in question arose through a spontaneous parthenogenesis, but this is hardly probable. Natural parthenogenesis is an exceedingly rare occurrence in vertebrates, in which it never seems to progress beyond a few early cleavages, as described in the armadillo by Newman (1913). So far as I am aware, parthenogenesis is quite unknown in fishes.

An assumption of self-fertilization in the scup entails another assumption, namely, that teratological hermaphroditism has occurred. Unfortunately, no such case seems to have been reported in *Stenotomus chrysops.* However, hermaphroditism is known to occur in other members of the Sparidae. The daurade, *Chrysophrys auratus,* is normally hermaphroditic (the male and female sex cells ripen alternately—Brock, 1878); hermaphroditism occurs in large numbers of individuals of *Sargus annulatus* (MacLeod, 1881; Stéphan, 1901); also, the Cambridge Natural History (7, 1904: 665) states that "some of the Atlantic and Mediterranean species of *Box, Sargus, Charax, Sparus* and *Pagellus* are known to be normally, or at least very frequently, hermaphrodite." Hence the discovery of the same condition in *Stenotomus* could hardly evoke surprise. Moreover, some authors have considered all fishes to be potentially hermaphrodites

at the time of the embryonic cleavages, and from this basic condition males, females or hermaphrodites arise according to the environmental influences. Mršič obtained seven hermaphroditic rainbow trout from eggs that were delayed twenty-one days before fertilization. These were interpreted as being in process of change from one sex to the other. For a fuller discussion of this provocative topic, see Stéphan (1901), Gemmill (1912) and especially Mršič (1923).

Concerning the physiological potency of eggs to fertilization by sperm produced in the same individual, very little positive information is at hand so far as teratological hermaphroditism is concerned, but at least some of the ova in Stewart's trout are known to have responded positively. Dufossé's observations indicate potency of *Serranus* ova to fertilization by its own sperm, and the same has been observed in a few other animals, notably in the nematode *Angiostomum* (Schleip, Arch. f. Zellforsch., 1911, 7), and in the coccid insect *Icerya purchasi* (Hughes-Schrader, Ann. Entomol. Soc. Amer., 28, 1930: 362).

The conclusions to be drawn from this study are.—1. Advanced embryos were obtained by abdominal pressure upon an adult, apparently female, scup (*Stenotomus chrysops*). 2. Of several suggested explanations, the assumption of hermaphroditism with consequent internal self-fertilization seems the most plausible one.

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The Use of the Generic Name *Ophis* for an Eel, a Snake and a Mollusc

By CARL L. HUBBS

THE name *Ophis* has been independently proposed at least three times, in as many different groups of animals. The first proposal of the name, for a genus of eels, has unfortunately been generally if not universally overlooked, as I find no reference to it in the standard nomenclators (Marshall; Agassiz; Scudder), nor in Günther's *Catalogue of the Fishes in the British Museum,* nor in Jordan's *The Genera of Fishes.* The name was, however, proposed in a manner leaving no doubt as to its availability under the Rules. To prove the point, I quote pertinent paragraphs from the original work in which the name appeared: W. Turton's *British Fauna, Containing a Compendium of the Zoology of the British Islands: Arranged According to the Linnean system,* Swansea, 1807.—

CLASS IV. PISCES. *FISHES*

Animals inhabiting waters, furnished with gills for the purpose of breathing, and fins for swimming.

Order I. APODES.
Bony fishes, without ventral fins.

1. ANGUILLA. *Head* smooth: *nostrils* tubular: *eyes* covered with the common skin: *gill-membrane* 10-rayed: *body* roundish, smooth, mucous: *dorsal, caudal* and *anal-fins* united: *spiracles* behind the head or pectoral fins.
2. OPHIS. Habit of the Anguilla, but the *tail* is without fin at the end, causing the dorsal and anal fins to be distinct.

On page 87 the genus name reappears, with one species, in the following form.—

2. OPHIS. Sea Serpent.

4. O. *maculata.* Silvery, with dark-brown spots.
Spotted Sea Serpent. *Shaw Zool.* iv. *p.* 22. *tab.* 2. *Bloch* t. 154.

Body 3 or 4 feet long, slender, silvery-white with a triple row of dark-brown oblong spots: *head* slender: *eyes* moderate: *mouth* wide: *teeth* curved inwards: *pectoral-fins* small, white: *tail* naked, round, pointed. *Berkenhout.*

The name *maculata* (or *maculosa*) was generally treated by the early authors, as Shaw and Bloch, as synonymous with *Muraena ophis* Linnaeus, which species name presumably suggested the genus name *Ophis*, as well as the prior name *Ophichthus* of Ahl. As the type-species of *Ophichthus* is, according to Jordan, without question assumed to be *Muraena ophis* Linnaeus, we may take *Ophis* Turton, 1807, to be a synonym of *Ophichthus* Ahl, 1787.

Clearly this use of the name *Ophis* in 1807 precludes its later use for any other genus. This is unfortunate, as the name is now in use in herpetology. Wagler, in Spix's *Serpentum Brasiliensium*, 1824, p. 47, in proper form proposed the name *Ophis* for a genus of South American colubrid snakes. Boulenger, in his *Catalogue of the Snakes in the British Museum*, 2, 1894, p. 144, arbitrarily listed this name as a synonym of *Xenodon* Boie, 1827. Lately, however, the name has been accepted, as by Dr. do Amaral (Mem. Inst. Butantan, 4, 1929 (1930?): 175). Whether the name of the snake genus *Ophis* (and of the subfamily Ophiinae based thereon) needs to be replaced, and if so by what name, I must leave to herpetologists to decide.

A third use of the name, for a mollusc, has been noted in the nomenclators, though it appears to have generally escaped the attention of conchologists. Agassiz cites "**Ophis** Gray Syn. Brit. Mus. 1840 ὄφις, serpens ***Naïadea***." According to the *Catalogue of the Library of the British Museum*, it was the forty-second edition of the *Synopsis of the Contents of the British Museum* which was published in 1840. Whether the name appeared in any of the earlier editions I have not determined, but it apparently did not appear as early as 1807, when the name *Ophis* was used for an eel, as the first edition of the *Synopsis* is listed as having appeared in 1808.

In summary: the proposal of the generic name *Ophis* for an ophichthid eel by Turton in 1807 precludes the use of this name for a snake (Wagler, 1824) or for a mollusc (Gray, 1840), even though *Ophis* Turton, 1807, is regarded as a synonym of *Ophichthus* Ahl, 1787.

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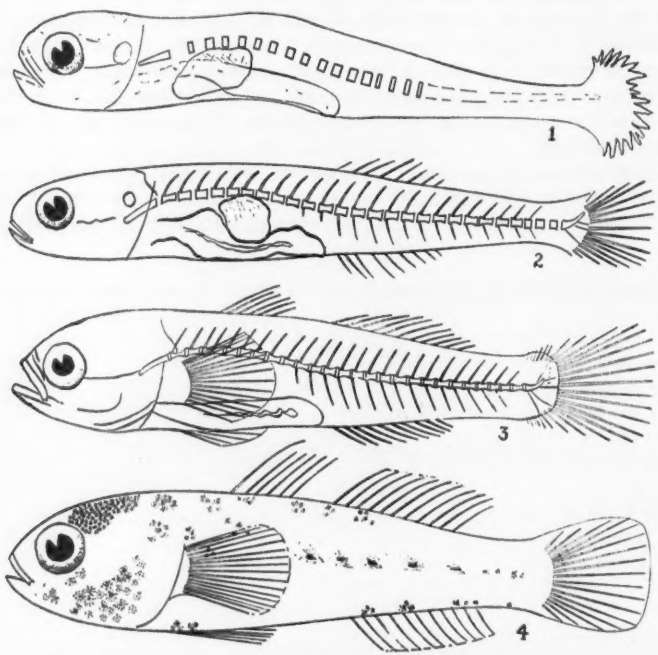
A Contribution to the Life History of *Gobiosoma molestum*

By Ralph F. Shropshire

A COLLECTION of plankton was made by Mr. Louis L. Babcock, of Buffalo, while in Florida during the months of May and June, 1931. This plankton collection was made by him in the hope of adding to the knowledge of the life history of the tarpon (*Tarpon atlanticus*), and was turned over to the writer to study for that purpose. During the course of this work, a number of larval fish were examined, and really quite accidentally, a fairly complete series of specimens of *Gobiosoma molestum* was developed. This report is submitted here merely as one of the odd by-products of a study not as yet completed, with the thought that it may in a small way add to our knowledge of the larval stages of a form which is quite common on our Atlantic coast. An adult specimen of this fish was forwarded to Mr. Barton A. Bean, of the U. S. National Museum, and identified by him as *Gobiosoma molestum* Girard.



Figs. 1-4. Early stages in the life history of *Gobiosoma molestum*.

3.54 *mm. stage* (Fig. 1).—The smallest specimen obtained was of a length of 3.54 mm. and is principally characterized by the following: The ossification consists of 18 vertebrae as shown in the accompanying figure, and the beginning of ossification of the labial portion of the mandible and the premaxillary. Dimensions are as follows: Total length 3.54 mm.; length of head 0.83 mm.; diameter of eye 0.25 mm.; greatest depth of body 0.50 mm.

6.37 *mm. stage* (Fig. 2).—The next specimen in the developmental series, as shown in Figure 2, had a total length of 6.37 mm. All vertebrae show distinct signs of ossification. Eight dorsal rays, 9 anal rays, and 16 caudal rays. In addition there is an ossification of the branchiostegals and the beginning of the ossification of the quadrate and the opercle. In this stage, also, the beginning of the differentiation of the gut is apparent. The dimensions are as follows: Total length 6.37 mm.; length of head 1.54 mm.; greatest depth of body 1.0 mm.; diameter of eye 0.36 mm.; length from snout to end of last vertebra 5.71 mm.; longest caudal ray 0.51 mm.; longest dorsal ray 0.35 mm.; longest anal ray 0.33 mm.

8.78 *mm. stage* (Fig. 3).—Total length 8.78 mm.; diameter of eye 0.56 mm.; length of head 2.22 mm.; greatest depth of body 1.59 mm.; width at base of pectoral 0.56 mm.; measurements of base of first dorsal 0.83 mm.; second dorsal 1.66 m..; anal 1.49 mm.; caudal from last vertebra 1.59 mm.; length from snout to last vertebra 7.29 mm. Ossification of premaxillary, mandible, gular plate, frontal, parietals, ethmoid, ceratohyal, and epihyal is noticeable. At this time 6 spines of the first dorsal are quite distinct in addition to the following: Posterior soft dorsal consisting of 11 rays; 10 anal rays; 15 pectoral rays; and the closely placed pair of the 5-rayed ventrals. Developing teeth are barely discernible in lower jaw; practically no pigmentation.

Another specimen of the same length (8.78 mm.), shown in Fig. 4, differs very little from that of the previous figure except in the increase in pigmentation, the appearance of tubular nostrils, and of a series of rows of papillae on the lower jaw, forehead, and cheeks.

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Ichthyological Notes

THE OSTEOGLOSSID FISH *SCLEROPAGES* IN THE MALAY PENINSULA.—Dr. Hugh M. Smith's note on the occurrence of *Scleropages formosus* in Siam (COPEIA, 1931(2):64) is an interesting one. It is, as he remarks, the first record of this peculiarly primitive fresh-water fish from the Asiatic mainland. The fact that *Scleropages* is found on the mainland was, however, brought to the present writer's attention in a rather odd way several years ago. He was thumbing through a copy of C. W. Harrison's "An Illustrated Guide to the Federated Malay States," published in 1923 by the Malay States Information Agency, 88 Cannon Street, London, E.C. 4, in the hope (as yet unrealized) of making a trip to this interesting region. On one of the plates (facing p. 179) there is a photograph of three strings of fish taken by rod and line at Bukit Merah Reservoir in July, 1922. The photograph is rather small and the fish are many but there is no mistaking six specimens of *Scleropages* at the left end of the middle string. Bukit Merah Reservoir is in the Krian District of Northwestern Perak, nearly north of Taiping and east of Began Serai. This is far from Smith's record (Krat, Southeastern Siam) and indicates that *Scleropages* is widely spread in Southeastern Asia.

Since the above was written, I have received a paper from Dr. Smith (Journ. Siam Soc., Nat. Hist. Suppl., 3, 1931:177-190) in which he notes that *Scleropages* has been recorded very recently (Ann. Rept. Fisher. Dept. Straits Settlements and Fed. Malay States for 1930, published in 1931) from Bukit Merah Reservoir and from Tasek Bera, Pahang. Since these records appear to be rather obscure it seems worth while to call attention to them.—GEORGE S. MYERS, *Stanford University, California.*

NEALOSA HERRE AND MYERS EQUALS *KONOSIRUS* JORDAN AND SNYDER (CLUPEIDAE).—Through an unpardonable bit of carelessness on the part of the present writer, the new generic name *Nealosa* has been proposed by Herre and Myers (Lingnan Science Journal, 10, 1931:235) for *Chatoessus punctatus* Schlegel, for which the generic name *Konosirus* Jordan and Snyder (Proc. U. S. Nat. Mus., 33, 1900:349) was already available. Fortunately the writer detected the error before most of the reprints had been sent out. The genus *Konosirus*, of which *Nealosa* is an absolute synonym, is well distinguished from *Clupanodon*, with which it has lately been confused, by a number of important characters pointed out by Herre and Myers.—GEORGE S. MYERS, *Stanford University, California.*

A NEW NAME FOR A MELANESIAN PSEUDOCHROMID FISH CONFUSED WITH *NESIOTES PURPURASCENS* DE VIS.—In 1884 De Vis (Proc. Linn. Soc. New South Wales, 8:453) described a peculiar fish, *Nesiotes purpurascens*, from the "South Sea." Nothing more was heard of the species until 1926. In that year McCulloch (Biol. Res. Fish. Exper., "Endeavour," 5(4):185-186 and 188-190, pl. 49) identified some damaged specimens of a *Pseudochromis* from the New Hebrides in the Queensland Museum as the probable types of *Nesiotes*. In making this identification he states that the specimens "differ from De Vis' generic and specific descriptions in so many details that it is difficult to believe that they are the types" and that "nothing but the notorious inaccuracies of De Vis' writings justifies one in accepting these specimens as the types of *Nesiotes purpurascens*." Indeed it appears to be stretching a point to identify a fish with three dorsal spines with one said to have twelve. Fortunately the matter has been cleared up by the discovery of a fish in the New Hebrides by Dr. A. W. Herre which seems without doubt to be the true *Nesiotes* of De Vis. It agrees largely with the original description, both in proportions and fin formulae, and though it has much of the appearance of *Pseudochromis*, it represents an entirely different genus. The species is described and figured in Dr. Herre's forthcoming report on the fishes of the Crane Pacific Expedition. This assignment leaves the *Pseudochromis* described and figured by McCulloch without a specific name. I propose that it be called *Pseudochromis* **mccullochi.**—GEORGE S. MYERS, *Stanford University, California.*

A RECORD OF *SARDA VELOX* AND NOTES ON OTHER BLOCK ISLAND FISHES.—*Sarda velox* Meek and Hildebrand, described from the Pacific coast of Panama, was recorded from Block Island, Rhode Island, by Nichols and Breder, 1926,[1] and Breder 1929,[2] on a basis of the figure of a then unknown species by Stillman 1921.[3] The writer had an opportunity to check this identification in the field in the summer of 1931. The specimen examined was about 560 mm. in standard length and although in the process of being dressed for the table was clearly identifiable. The local fishermen referred to it simply as "bonito." They stated the species to be frequently taken and of good flavor.

Notes on other fishes made on three short cruises of the yacht *Querida* are listed below. The opportunity to make these trips was due entirely to the generosity of Mr. Daniel Bacon. The data, not especially dated, refer to the following periods: July 18 to 22, 1930; June 20 to 22 and July 10 to 13, 1931. Most of the notes are based on commercial fishermen's catches, some on minnow seine catches in the western harbor and others on personal fishing.

Mustelus canis (Mitchill).—Common, sometimes very large and often in the western harbor.

Prionace glauca (Linnaeus).—Common at times. A male harpooned by Mr. Bacon about ten miles south-southwest of Block Island on July 12, 1931, measured 8 feet 10 inches over all. Other measurements as follows: snout (to eye) 8½ inches, snout (to nostril) 4½ inches, width at nostrils 6 inches, pectoral insertion 22 inches, pectoral fin 24½ inches, pectoral inner margin 9 inches. Its stomach contained the remains of some fish (*Centropristes?*) and a large piece of flesh (offal from a vessel?).

Sphyrna zygaena (Linnaeus).—Common, both large and small. On July 20 and 21, 1930, hammer-heads were numerous about twenty miles southeast of Block Island.

Carcharias littoralis (Mitchill).—Fairly common. A seven foot female seen on July 11, 1931.

Squalus acanthias Linnaeus.—Common outside the harbor.

Raja erinacea Mitchill.—Common, especially in the pound nets and trawls.

Raja diaphanes Mitchill.—Common in pounds and trawls.

Raja eglanteria Lacépède.—Generally common.

Dasyatis centrura (Mitchill).—Common.

Leptocephalus conger Linnaeus.—Large specimens common.

Clupea harengus Linnaeus.—Common; small examples in the west harbor. On July 10, 1931, specimens about three inches long in large schools were observed to leap over broken fragments of *Zostera* in a manner similar to that described for various Belonidae at the Dry Tortugas by Breder 1929.[4] The action was clearly similar although more frequently specimens were noted to "scratch" themselves on entirely submerged fragments. This behavior on the part of three clupeids seems to be quite intermediate between the specialized scratching activity of belonids and the more generalized performances of various bottom fishes.

Fundulus majalis (Walbaum).—Common.

Fundulus heteroclitus macrolepidotus (Walbaum).—Common.

Syngnathus fuscus Storer.—Common in weedy places in the western harbor.

Menidia menidia notata (Mitchill).—Present in the western harbor.

Sphyraena borealis De Kay.—Specimens about two inches in length taken in the western harbor on July 22, 1930.

Ammodytes americanus De Kay.—Present in the western harbor.

Scomber scombrus Linnaeus.—Taken in the pound nets in the summer but not nearly as abundant as the following.

Pneumatophorus colias Gmelin.—Large adults, common in pounds and trawls.

Thunnus secundodorsalis (Storer).—Taken well off shore, principally on rod and reel.

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[2] Breder, C. M., Jr. Field Book of Marine Fishes of the Atlantic Coast, 1929. G. P. Putnam's Sons.

[3] Stillman, C. K. Bull. Amer. Game Protective Assn., Jan. 1921.

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Sarda sarda (Bloch).—Fairly common, much more so than *Sarda velox*.

Xiphias gladius Linnaeus.—The principal commercial fish of Block Island generally taken by harpoon. Relatively scarce on the dates of these visits.

Naucrates ductor Linnaeus.—Sometimes in the western harbor, about three inches long. Larger ones taken in pound nets.

Pomatomus saltatrix (Linnaeus).—Not especially common.

Poronotus triacanthus (Peck).—Taken in fair numbers in pound nets.

Centropristes striatus (Linnaeus).—Large ripe specimens abundant, but less so than at Montauk Point, Long Island. Old males with adipose hump on nape very brilliantly colored. At both these localities this species may be sexed at sight on a basis of color brilliance and fin filaments alone.

Stenotomus chrysops (Linnaeus).—Large specimens fairly common in pound nets.

Cynoscion regalis (Bloch and Schneider).—Present but not abundant.

Tautogolabrus adspersus (Walbaum).—Very common, especially in the harbor. Individuals are frequently found carrying large numbers of small black cysts of some trematode.

Tautoga onitis (Linnaeus).—Not especially common, but most often taken in company with *Centropristes*.

Spheroides maculatus (Bloch and Schneider).—Present but not especially common.

Myoxocephalus aeneus (Mitchill).—Fairly common in shallow weedy places in the western harbor.

Myoxocephalus octodecemspinosus (Mitchill).—Present in pound net and trawl catches.

Cyclopterus lumpus (Linnaeus).—One specimen of about eight inches in a trawl on June 22, 1931.

Prionotus carolinus (Linnaeus).—Taken chiefly in pound nets but not especially common.

Opsanus tau (Linnaeus).—Common.

Merluccius bilinearis (Mitchill).—Exceedingly abundant in all commercial fishing gear.

Pollachius virens (Linnaeus).—Small ones sometimes taken.

Gadus callarias Linnaeus.—Irregular, but not unusual in pound nets.

Phycis tenuis (Mitchill).—Fairly common.

Phycis chuss (Walbaum).—Very common.

Paralichthys dentatus (Linnaeus).—Very large specimens common in pound nets and trawls.

Pseudopleuronectes americanus (Walbaum).—Common in all gear and in the western harbor.

Lophopsetta maculata (Mitchill).—Abundant. Those in commercial gear of a very large average size.

Achirus fasciatus Lacépède.—Frequently present in commercial catches.—C. M. Breder, Jr., *New York Aquarium, Battery Park, New York City.*

RECORDS OF THE ALEWIFE AND STEELHEAD (RAINBOW) TROUT FROM LAKE ERIE.—Mr. A. B. Hoover of Nanticoke, Ontario, on Lake Erie, on September 23, 1931, sent to the Department of Fisheries at Ottawa, Ontario, three species of fish apparently taken by Captain Robinson. These specimens have come to us for identification. Two of them seem worthy of record.

Pomolobus pseudo-harengus, alewife.—This species is common in Lake Ontario, but appears never to have been recorded previously from Lake Erie. Mr. Hoover states that it is a new species which they had never seen in the lake before. Although we have not been able to make a comparison with the related species *Pomolobus chrysochloris*, which has been recorded (perhaps erroneously) from Lake Erie, the specimen sent by Mr. Hoover, which was 7¾ inches long, is undoubtedly *Pomolobus pseudo-harengus*. In 1921 the marine lamprey, *Petromyzon marinus*, was discovered in Lake Erie and the eel had formerly been found there. The suggestion has been made that these animals reached Lake Erie through the Welland Canal as both of them were absent under original conditions. It seems probable that the alewife has followed the same course.

Salmo gairdnerii, steelhead rainbow.—Mr. Hoover states that the local fishermen

call this fish landlocked salmon and that it looks like a speckled trout, also that they occasionally get one weighing seven or eight pounds. This species was introduced by the United States Fish Commission into Lake Superior waters in 1895. It is quite common at Sault Ste. Marie and has gradually extended its range southward for some years. We have quite a number of records from streams flowing into Georgian Bay. In 1920 Dr. W. A. Clemens got a small specimen in Lake Erie which is now in our collection.

It has recently been reported from western Lake Erie, where its occurrence has been attributed to escapement from a trout stream in Ohio, by Osburn, Wickliff and Trautman (Ohio Jour. Sci., 30, 1930: 171). During the last year or two reports of the occurrence of these fish in Lake Erie have become increasingly common.—JOHN R. DYMOND, *Royal Ontario Museum of Zoology, Toronto, Ontario.*

A FIVE-SPINED SPECIMEN OF *APELTES QUADRACUS* (MITCHILL) FROM CONNECTICUT.—An interesting specimen of this stickleback with 5 instead of 4 dorsal spines was taken August 9, 1931, in a surface net over eel grass near Sunken Rock in Cos Cob Harbor, Connecticut, in shallow cloudy brackish water near the mouth of the Mianus River. It measures 24 mm. to base of caudal. The first dorsal spine is inclined slightly to the right, second and third inclined sharply to the left, fourth and fifth very little if at all inclined. The five spines appear rather large: the first and second measure almost twice the eye, third and fourth are progressively shorter, the fourth being slightly longer than the eye. The fifth is about equal to the third in length and longer than the fourth.

Five-spined specimens of *Apeltes* are very common in the western portion of the Gulf of St. Lawrence, as Philip Cox has pointed out in *The Canadian Field Naturalist* (37, 1923: 146-147), but have not generally been reported from southern localities. Hildebrand and Schroeder, however, in their "Fishes of Chesapeake Bay" (Bull. U. S. Bur. Fish., 43 (1), 1928: 180), give the number of dorsal spines as 3 to 5, commonly 4 or 5. A study of the variation in the number of dorsal spines in *Apeltes* would be very interesting.

In an aquarium the fish had the characteristic bright red color of *Apeltes* on its ventrals.—J. C. ARMSTRONG, *The Choate School, Wallingford, Connecticut.*

NOTE ON TRINIDAD *CORYNOPOMA*, AND ON COLOR VARIATION IN 'GUPPYS'.—Eigenmann and Myers 1929 in *The American Characidae*, pt. 5, p. 470, suggest that if *Corynopoma riisei* Gill has the peculiar characters they describe in *C. aliata*, the two may be conspecific.

We have received from Trinidad two specimens collected by Mr. and Mrs. Dudley Parsons, in 1931. The larger specimen, 36 mm., exhibits some of these characters; the other, 32 mm., all of them. In the 36 mm. specimen we find the caudal split to base, and the pointed opercle; in the 32 mm. specimen, the caudal is split to base, lower lobe much the longer, lower fulcra separated from fin and forming a spur, basal scales of lower lobe united and bulging over a cavity between them and caudal. The last anal ray is produced. The opercle is prolonged in a style with an expanded dermal flap over the beginning of the caudal peduncle. Measurements also bridge slight differences in the descriptions of the two forms.

The presumption is, therefore, that *Stevardia aliata* Eigenmann (1914), from "base of Andes east of Bogotá," is a synonym of *Corynopoma riisei* Gill 1858, but the two schould be carefully compared.

According to Jordan (*The Genera of Fishes*, 2, 1919: 281), *Corynopoma* is a synonym of *Stevardia*.

Mr. Parsons was particularly interested in color variation, by locality, in the "guppys," and reports as follows concerning this:

"A few *Acanthophacelus reticulatus* [=*Lebistes reticulatus*] were included among the specimens because of the extreme variation of color, color distribution and caudal fin formation. Unfortunately, little of the color was preserved by the formalin, but possibly some of the caudal fin formations have been preserved intact. Some importance has been attached to these variations due to current impressions, at least among aquarists, that sword-tail and certain unusual types of *Acanthophacelus reticulatus* are the products of hybridization. However, upon examination of only a few hundred

specimens caught in a state of nature in Trinidad, particularly in the Blue Basin at Diego Martin (el. 1200 ft.) and the Santa Cruz Valley (el. about 250 ft.), we found types of every variation we had ever seen in tanks in this country, except colored dorsal fins and cold color [lacking any vivid color]. This was in accord with the observations of Mr. Guppy also. However, colored dorsal fins were found by us in St. Lucia and two years ago in Jamaica, while cold color and generally larger *Acanthophacelus reticulatus* constituted about 15 per cent of those taken in St. Lucia. So far as Trinidad is concerned, at least, the variations would not appear to be the result of hybridization in a state of nature, particularly recently, as, according to Mr. Guppy, only two other viviparous fish are now extant upon the island: a *Platypoecilus* [-like fish] and another of similar characteristics, both inhabiting brackish water, both lightly and evenly pigmented and neither demonstrating a tendency to variations in fin formation from the *Platypoecilus* type. To the best of my knowledge, aquarists have never succeeded in improving upon nature in breeding *Acanthophacelus reticulatus* and the reasons for variation have not been established. We were unable to establish that environment caused these variations although some localities produced more brilliant coloration than others. Nevertheless, I might venture the theory that each stream would tend to produce its own type but that considerable transplanting takes place during the flood seasons when virtually all the streams of Trinidad are interconnected, accounting for the variations in ancestry of present types and their present mixture." —FRANCESCA LAMONTE, *American Museum of Natural History, New York City.*

A MID-WINTER MIGRATION OF GIZZARD SHAD.—For several weeks during the past winter fishermen about Shakopee, Minnesota, had reported great numbers of a "strange fish" in the Minnesota River and its tributary streams near the village. The fish proved to be the gizzard shad, *Dorosoma cepedianum* (LeSueur) Gill.

The fish appeared about the first of December, and were present until late in January, and during this period they were present in such numbers that the townsfolk scooped them out of the small streams and brought them home to feed to the poultry and dogs. They reported that the fish were so sluggish that scooping out a tub full was the work of but a short time. Many of the people prepared and ate the fish with evident relish, not knowing that Jordan and Evermann characterize it as "a handsome fish, of no value as food."

The only information at hand indicates that the normal season for a migration of the gizzard shad into small streams would be late spring. Perhaps the extreme mildness of our weather in the early part of the winter would account for this untimely movement.—GUSTAV SWANSON, *Department of Zoology, University of Minnesota, Minneapolis, Minnesota.*

Herpetological Notes

A NEGLECTED DESCRIPTION OF A MEXICAN GARTER-SNAKE, *THAMNOPHIS STEJNEGERI* McLAIN.—Three obscure privately printed papers on North American herpetology were published by Robert Baird McLain at Wheeling, West Virginia, in February, 1899. All three bear at the top of their covers the common designation, *Contributions to North American Herpetology,* but they are not distinctly numbered. The papers are listed: *Critical Notes on a Collection of Reptiles from the Western Coast of the United States* (this is based principally on the collections of Stanford University, but also criticizes Van Denburg's *Reptiles of the Pacific Coast and Great Basin,* the criticism being avowedly based on a study of the California Academy material); *Notes on a Collection of Reptiles made by Mr. C. J. Pierson, at Fort Smith, Arkansas, with Remarks on Other Eastern Reptiles* (this paper records 43 species preserved in the Stanford Museum); and *Contributions to Neotropical Herpetology.* This last is the one with which we are principally concerned. It records 41 species from localities ranging from Lower California to Panama.

In this paper one new species is described, *Thamnophis stejnegeri* McLain, p. 4, from Salamanca, State of Guanajuato, Mexico. The name is not mentioned by Ruthven in his *Variations and Genetic Relationships of the Garter Snakes,* 1908, nor do I find other reference to it in the literature at hand. The type is still in the Stanford Museum, No. 4032, collected by A. J. Woolman. Superior labials are 8, scale rows 21-19-17, gastrosteges 163, urosteges 83, and the side stripe is anteriorly on the third and fourth scale rows. The lateral spots involve only the edges of the scales on which they are placed and the venter is clear except for a fine dark edging along the points of junction of the gastrosteges. The dorsal line is very distinct, on ½—1—½ scales. The dorsal ground color is very dark, the keels of the scales each with a fine whitish line, these forming five light hair-lines between the dorsal and lateral stripes. The fine plate of the type, drawn by W. S. Atkinson, gives a good idea of head and body pattern.

The snake is undoubtedly a specimen of *Thamnophis megalops* as at present recognized, of which the name *stejnegeri* becomes a synonym.—GEORGE S. MYERS, *Natural History Museum, Stanford University, California.*

TERRESTRIAL ACTIVITY OF SPADE-FOOT TOADS.—Following the Philadelphia meeting of the American Society of Ichthyologists and Herpetologists, several members, associated with members of the Society of Mammalogists, spent the week end of May 15-17, 1931, as the guests of Mr. Arthur N. Leeds, at Four-ways Cabin, on the Egg Harbor River in the heart of the New Jersey pine barrens.

About ten o'clock at night Mr. Arthur C. Emlen told us that a week previous he had discovered, with the aid of a flash light, a number of small toads out under the pines, by following up the pink eyeshine of the batrachians. This statement caused considerable interest and in a few minutes it was abundantly verified. Dr. Remington Kellogg, judging from an experience in the west (see below) some years previously, predicted that these Jersey toads would prove to be spadefoots (*Scaphiopus holbrooki*), and sure enough our specimens were at once recognized as this species.

On this and the following night we found the open pine woods fairly well populated with the toads and a number of specimens were obtained all of which seemed to be about half grown (body length 1.50 inches). They evidently burrowed in the dry sand during the day and came forth only late at night. Some were caught in the act of emerging from their burrows and were photographed successfully by Mr. Francis Harper with the aid of a flash light apparatus. Others subjected to the glare of the light rapidly dug themselves in, sinking "tail first" into the sand, and were a couple of inches down in as many minutes. Some individuals which I brought home and placed under a bell glass on a box of soil, at once disappeared in the earth but came forth again late the following night.

Previous to this experience my knowledge of the spadefoot was as a loud voiced

species usually frequenting temporary pools in early spring which, after pairing, disappeared no one knew where but probably to remain buried until the following spring. Their appearance in these dry pine woods was, therefore, to say the least, surprising although others have perhaps been aware of their nocturnal terrestrial habits.

Dr. Kellogg kindly offered me his unpublished notes on the habits of the western species (*S. hammondii*) to use in this connection but they are so interesting that they should be published in their entirety (see following note).—WITMER STONE, *Academy of Natural Sciences of Philadelphia.*

NOTES ON THE SPADEFOOT OF THE WESTERN PLAINS (*SCAPHIOPUS HAMMONDII*).—In the northern part of the great western plains this mysterious night-prowling toad is a common resident and is very interesting because of its adaptation to inhabit dry regions. It is commonly assumed that this toad remains in its burrows most of the year and that it emerges only to deposit its eggs in June and July in the pools formed by heavy rains. I doubt this very much since I have taken young spadefoots of this species which were not over an inch in length and there is reason to believe that these small toads hibernated over the preceding winter. An alternative interpretation, which is not so plausible on account of the lateness of the spring in this region, is that some of these spadefoots lay their eggs much earlier than this. According to the excellent observations of Strecker on a related species (Strecker, Proc. Biol. Soc. Wash., 21, 1908: 202), the development is very rapid, as the time from the laying of the eggs to their transformation and leaving the water does not exceed a period of 30 days. This rapid development is necessitated in part by the tendency of these pools of rain water to dry up very quickly. Wherever this spadefoot is found, its presence outside of its subterranean burrow during daylight hours is generally coincident with the breeding season or with heavy rains.

In suitable sandy areas, this nocturnal spadefoot comes out of its burrow during the summer months after it gets too dark for one to see objects without the aid of a flash lght. Along the Powder River near Powderville in Montana, on June 15, 1916, while lying upon my cot, I heard a curious rustling in the dry leaves about our tent. Upon investigation with a flash light many small spadefoot toads were found. They were hopping about in the dry leaves which were scattered about on the sandy soil. When hunted with a flash light they endeavored to burrow out of sight and but a few minutes were required for them to entirely conceal themselves. These spadefoots make circular holes in the ground and yet in sandy soil it is very difficult to find the place where they have burrowed down, for in most cases it seems as if they pulled the hole in after them. After the breeding season is over, they take more pains in constructing their burrows as they are well rounded and resemble somewhat an earthen jar with a narrow top. Around this opening there is present some sticky matter which may aid in the ensnaring of insects. I have usually found this toad most plentiful in sandy areas, especially along the banks of streams though they occur on the elevated plains from Kansas to Montana. The call of this toad is quite wierd and unusual, and may be likened to the squawk of some animal when severely injured, or a resonant *ye-ow.* Once heard this distinctive call is not likely to be forgotten.

Sixty-three specimens were collected at Powderville, Montana, on June 15-16, 1916 (Cat. Nos. 60360-60392, 60397-60407, 60459-60472, 60486-60490). These spadefoots are considered by some authorities to belong to the race *S. hammondii bombifrons.*—REMINGTON KELLOGG, *U. S. National Museum, Washington, D. C.*

PACIFIC RATTLESNAKE AT HIGH ALTITUDE ON SAN JACINTO PEAK, CALIFORNIA.—On a botanical collecting trip to the summit of Mount San Jacinto, Riverside County, September 1, 1930, I discovered a Pacific rattlesnake (*Crotalus confluentus oreganus*) in a large mat of chinquapin (*Castanopsis sempervirens*) only twenty feet, conservatively, from Sierra Club Register marking the actual summit of the peak, 10,805 ft. The morning was warm and cloudless and all of the boulders were already well heated. The specimen was of a dark steel-gray color and bore six rattles and a button, forming a triangle-shaped appendage. It was the only snake seen on the trip from Idyllwild to the summit.—JOSEPH EWAN, 1631 *Shatto Street, Los Angeles, California.*

FOOD OF SOME FLORIDA SNAKES.—Very little study has been made of the food of snakes in this country from actual examination of the contents of stomachs. The notes here given are the result of the examination of stomachs of snakes collected for the most part in Alachua County, Florida, from 1928 to 1930.

Liodytes alleni (Garman).—Of sixty-four stomachs examined, seven contained crayfish, making up 73 per cent of the bulk; two contained *Pseudobranchus striatus*, making 14 per cent of the bulk; two contained frogs, making 13 per cent of the bulk, and fifty-five stomachs were empty. Most of these specimens were taken shortly after dark, during the months of July and August, 1928, at Payne's Prairie, six miles south of Gainesville, Florida.

Farancia abacura (Holbrook).—"Mud eels," *Siren lacertina*, were found in seven of the twenty-five stomachs examined, and accounted for 56 per cent of the bulk of the food; salamanders made up 22 per cent of the bulk, and were found in two stomachs; 8 per cent of the bulk consisted of frogs, which were found in one stomach; one stomach contained fish, making 14 per cent of the bulk; sixteen stomachs were empty.

Natrix cyclopion (Duméril and Bibron).—Seventy-five stomachs were examined; 66 per cent of the food consisted of frogs, which were found in ten stomachs; fish were found in four stomachs, and made up 26 per cent of the bulk; salamanders, which were found in but one stomach, accounted for 8 per cent of the bulk; sixty-two stomachs were empty.

Opheodrys aestivus (Linnaeus).—Seventeen stomachs were examined; the chief food was insects, which were found in five stomachs, and constituted 53 per cent of the bulk; spiders, mostly of the family Lycosidae, were found in four stomachs, and made up 35 per cent of the bulk; one stomach contained a frog, making up 12 per cent of the bulk; nine stomachs were found to be empty. The insects found in the stomachs of this species consisted mostly of Lepidoptera larvae.—O. C. Van Hyning, *Florida State Museum, Gainesville, Florida.*

TURTLES EAT HERON—At Wading River, Long Island, New York, there is a series of small fresh-water ponds draining into Long Island Sound. During August, 1930, these ponds carried large populations of several species of turtles. The margins of these ponds were also frequented by several species of birds. At 11:00 A. M. on the morning of August 18 a little green heron (*Butorides virescens*) was seen floating dead, on the surface of one of the ponds near its border. As I came to the edge the body of the bird was pulled further out into the pond by one or more turtles. Several were milling about the body. Twenty were counted swimming in the vicinity. Of these, one spotted (*Clemmys guttata*) and two painted (*Chrysemys picta*) were recognized. With the aid of a string, I pulled the bird in for examination. Skin and flesh were gone from the head and neck. The body was then returned to the turtles. At 12:30 P. M. the bird was again seen close to shore. Feeding from the bird was a snapping turtle (*Chelydra serpentina*) of about nine inches carapace length. At 1:30 P. M. little was left of the bird but feathers and bones. Several turtles, among them a painted, were feeding at the time. There was no evidence as to whether the bird had been captured alive by a turtle or had been picked up as carrion.—Robert T. Hatt, *American Museum of Natural History, New York City.*

A NEW SKINK FOR COLORADO.—On November 17, 1926, Mr. J. G. Cozine presented the Colorado Agricultural College Museum with two specimens of *Eumeces fasciatus*. These specimens were taken 12 inches under ground, 14 miles north of Fort Collins. They were determined by Professor J. E. Guthrie, of the Iowa State College. To the best of my knowledge this is the first record for the state.—W. L. Burnett, *State Agricultural College, Fort Collins, Colorado.*

NOTES ON POISONOUS SNAKES IN TEXAS.—On the occasion of a brief visit to Texas in late September, Mr. Roy Quillin, well-known ornithologist of San Antonio, arranged an outing on the twenty-eighth of the month to the cattle ranch of John P. Classen, about 25 miles north of the city. The ranch covers a section, more or less hilly, in a fossil-bearing limestone formation with deep, rocky channels along the winding course of the Cibelo River and its tributaries. Live oak and cedar are

the principal shrubby vegetation. The region is noted as a haunt of rattlesnakes and a first hand acquaintance with one or more of the Texan diamond backs was anticipated. The day turned out cloudy with occasional showers and rather chilly. The rattlers kept out of sight.

On the steep slope of the river channel we came across a coral snake heading for the cover of a near-by thicket at a lively rate. Pulling it out into a clearing, it at once assumed a defensive attitude by repeatedly biting and holding its grip on a stick, meanwhile whipping and throwing about its body violently. During these maneuvers we noted particularly that the end of the tail had been twisted into a regular knot, the tip extending slightly through the loop. These tactics rendered it extremely difficult to distinguish the head from the tail end and called for great caution in the final capture of the snake alive. The specimen measures twenty-one inches. It is heavily marked with black spots and patches on the red bands, including the ventral side, otherwise is a normal example of its kind. An encounter with this harlequin among our serpents always is a thrilling experience. Observations on its behavior, even with the chance that they have been recorded before, seem worth while repeating.

A week later, or to be exact, on October 5, while staying at the Tippit's Ranch, Mitre Peak, Davis Mountains, the writer captured a small copperhead, *Agkistrodon mokasen*, only eleven inches long, found coiled in the fork of a live oak about four feet above the ground. Three years ago on another visit, a mature example of this species was seen, collected by a man connected with a medicine show. He had it in a box tied to the back of his car. Exposed to the hot sun the snake had died when he reached the town of Alpine, twelve miles away. In arid regions viperine snakes are seldom encountered during the heat of the day. Copperheads are not uncommon in the Davis Mountains, which is about the western limit in the range of the species.

The prevailing rattler in these mountains appears to be *Crotalus molossus*, of which a handsome example, thirty-one inches long, was taken on a trail in the narrow gorge north of Mitre Peak. It gave one brief, strident warning and was easily captured. The people on the ranch declared that it was the kind with which they were well acquainted. They knew nothing of the red rattler, *Crotalus ruber*, doubtfully recorded from the mountains.—GEO. P. ENGELHARDT, *Hartsdale, New York.*

ANOTHER RECORD FOR THE MARBLED SALAMANDER IN WASHINGTON.—While collecting tadpoles of *Ascaphus truei* Stejneger last summer (1931) from Thetis Creek, which flows into Lake Kachess, Kittitas County, Washington, four larvae of *Dicamptodon ensatus* Eschscholtz were also collected. These larvae measured 130, 185, 195 and 205 mm. and were found under rocks in the swiftly flowing water. Myers (COPEIA, 1931, No. 2: 56-57) also found this salamander in streams inhabited by *Ascaphus truei*. This marks the second time that the marbled salamander has been found east of the Cascade Divide.—ARTHUR SVIHLA and RUTH DOWELL SVIHLA, *Chas. R. Conner Museum, Pullman, Washington.*

REVIEWS AND COMMENTS

COPE: MASTER NATURALIST. THE LIFE AND LETTERS OF EDWARD DRINKER COPE WITH A BIBLIOGRAPHY OF HIS WRITINGS CLASSIFIED BY SUBJECT. A STUDY OF THE PIONEER AND FOUNDATION PERIODS OF VERTEBRATE PALEONTOLOGY IN AMERICA. By Henry Fairfield Osborn with the co-operation of Helen Ann Warren. xvi+740 pp. 30 pls. Princeton University Press, Princeton, New Jersey, April 27, 1931. $5.00.

BIOGRAPHICAL MEMOIR OF EDWARD DRINKER COPE, 1840-1897. By Henry Fairfield Osborn. National Academy of Sciences of the United States of America, Biographical Memoirs, Vol. XIII, Third Memoir, 1930, pp. 127-317, 1 pl.

There has recently been published the biography of a great naturalist, a man who, through the brilliance of his researches, the breadth of his vision, and the very volume of his fundamental contributions, perhaps deserves to be called the greatest naturalist that America has ever produced. Edward Drinker Cope was not only America's most brilliant vertebrate paleontologist. He was by far her foremost herpetologist and one of her outstanding ichthyologists and mammalogists. Indeed it is possible that no one before or since has had such a grasp of vertebrate zoology as a whole or made such fundamental contributions to its literature.

This biography is by Cope's foremost student, one who knew Cope intimately during the last part of his life and who appreciated both the greatness and the failings of the Master Naturalist. As its subtitle indicates, the book deals largely with Cope's work as one of the founders of vertebrate paleontology in America and herpetologists and ichthyologists are apt to feel that their subjects have been somewhat slighted. But we must realize, as all who read this volume surely will, that paleontology was Cope's best loved and most prolific field.

The book opens with the work of the pioneers of vertebrate paleontology in America, from Joseph d'Acosta to Jefferson, Harlan and Warren and their work up to the dawn of the great discoveries in the West by Leidy, Cope, and Marsh. With this background the author begins the life of Edward Drinker Cope.

To those of us who have known Cope largely through his published work, the account of his boyhood in the strict atmosphere of a Quaker home and school is of singular interest. His boyish letters, asking his father for paper, or ink, or a few "goodies," and giving us a view of his awakening interest in natural history are priceless.

The story proceeds with his training in adolescence and early manhood, his disinclination for farming, his first contacts with Leidy, Baird, and Gill, and his gradual trend towards a scientific career. In his first European journey of 1863-1864, we find him meeting the great naturalists of Europe, working at the British Museum and the Jardin des Plantes, meanwhile struggling to reconcile his work and developing ideas with the philosophy he had been taught to revere. Cope's accounts of his travels in letters to his family are vivid and in places approach the poetic, as in his description of the rising moon over the Adriatic at Venice (p. 127). Finally, on his return home, comes his final decision and the dedication of his life to science.

With Cope's marriage and the end of farming begins his life of exploration, first in the east and then in the wild lands of the western territories where he made his greatest discoveries. We can well understand what drew Cope from his fishes and amphibians and reptiles to a search and positve passion for the bones of the strange creatures of bygone eras if we consider the state of vertebrate zoology in America in 1865. The main features of recent vertebrate life in the eastern states were by that time well known. Only the fishes of the Appalachian streams offered much in the way of novelty and Cope was already well on the way to making the majority of them known. Numerous herpetological and ichthyological collections from the unknown areas of tropical America passed through his hands, resulting in a long series of papers, but his awakening interest in fossils led him to undertake many excursions

to the relatively poor deposits of vertebrates in the eastern states. These occupied him for some time but his ravenous mind needed greater food. The rumors of the rich beds of utterly unknown creatures in the west and the crumbs which were brought back to his teacher and friend, Joseph Leidy, pointed the way.

Through Cope's letters we see his first glimpse of the prairies and buffalo where he entered the Kansas fossil fields in 1871, and his experiences in the Bridger and Washakie basins where he discovered the great horned *Loxolophodon*. We follow him from the titanothere beds of Colorado to the dinosaur beds of the Judith River Cretaceous. Who will not thrill at Cope's tales of travels in stage coach and mule cart through country inhabited by hostile Indians for the first exploration of the formations which have yielded such a wealth of the gigantic creatures which peopled the past? His letters give a view of stirring times, when not only great things in science, but far-reaching events in the history of the nation, were in the making.

Cope described these collections, the while becoming entangled in his well-known dispute with Marsh over publication dates, and in 1878 we see him in Europe again, now one of the foremost of naturalists, with honors heaped upon him. Then follow graphic accounts of his further explorations in the west, his heart-breaking fight for governmental funds to publish his works, and his ill-fated venture into mining in the hope of retrieving his waning fortune. This was the golden period of his philosophic interpretation, when his greatest papers on the classification of vertebrates appeared. Lastly we see his final explorations in Texas and Dakota and his life as professor at the University of Pennsylvania. During this period occurred the last explosion of the Cope-Marsh war, an event which is, unfortunately, the chief remembrance of Cope by many zoologists. In fairness to Cope, it should be said that one who reads all the documents of the various clashes, including those published by Marsh's former assistants, comes away with the feeling that Cope was usually more than half in the right. Osborn gives an apt quotation concerning the disputes from one of Cope's letters, "Cuvier never had as important and curious forms to illustrate, and it seems incredible that our societies should be mean about it."

The story concludes with Cope's sad decline and his death in 1897, and an estimation of his contributions in various fields, by Osborn, Gill, Gregory, and Noble. Ichthyologists are apt to feel that some of Cope's important fish work has been neglected. His works on the numerous fresh-water cyprinoids and catostomids of the eastern states, the Alleghanies, the Mississippi Valley, and the Rocky Mountain region are many. Though, like those of other writers of his time, many of his names have fallen as synonyms, a surprising number of them persist. His papers on the teeming fish fauna of the Upper Amazon are even today the best and most comprehensive accounts of the ichthyology of this little known region. Of course the title of the volume indicates that Cope's major work, paleontology, is the chief concern of the authors, as it should be, but it seems possible that much of great interest concerning Cope's ichthyological and herpetological work has been omitted from the voluminous correspondence given to us by Dr. Osborn.

Appended to the biography is a list of Cope's 1395 publications, a mute testimony to his unremitting zeal and tremendous energy in his chosen field. The authors have attempted to divide this bibliography into sections on different subjects. This is, in the reviewer's opinion, an unhappy arrangement, since many of Cope's papers include notes on two or three of the vertebrate classes and still more do not admit of placement in categories down to orders, as has been attempted. This list is a rearranged duplicate of the chronological bibliography in the National Academy.

There are several slips in the book, such as in the names of Albert C. L. G. Günther (p. 244), Alpheus Hyatt (p. 528), and W. Healey Dall (p. 528). The statement (p. 155) that Cope's last cave exploration was that in the Wyandotte Cave in 1871 is considered doubtful by the reviewer. The trip to the Nickajack Cave, Tennessee (see *Amer. Nat.*, Nov., 1881, p. 877) was probably later. One serious defect in the book is the lack of an index.

Although the biography is in large part woven of Cope's own letters in some cases with rather too little narrative to hold them together into an easily readable whole, all of us must feel grateful to Dr. Osborn and Miss Warren for preserving this precious record of one of America's greatest scientists. We marvel that so much of

Cope's correspondence has been preserved and we owe much to the authors for placing a great amount of it in available form. The volume is decidedly a great record of the life of a great man, and it should be of especial interest to readers of COPEIA, which bears the name of the Master Naturalist.

The National Academy Memoir of Cope's life, which appeared almost simultaneously with the larger volume, is, in effect, a condensation of it. The chief feature is the carefully compiled chronologically arranged bibliography of Cope's works, a list which will be ever so much more useful to workers in general than the one in the larger volume.—GEORGE S. MYERS, *Stanford University, California.*

AN INTRODUCTION TO THE LITERATURE OF VERTEBRATE ZOOLOGY based chiefly on the titles in the Blacker Library of Zoology, the Emma Shearer Wood Library of Ornithology, the Bibliotheca Osleriana, and other libraries of McGill University, Montreal. Compiled and edited by Casey A. Wood. 4to, pp. xix+643, col. frontisp. Oxford University Press, London, 1931. Fifteen dollars or three guineas.—The content of this magnificent and beautifully published volume is indicated in the official announcement as being "divided into three main sections. The *first* consists of introductory matter which furnishes a brief account of the literature of Vertebrate Zoology from the earliest times to the present—from the writings of ancient and medieval zoologists...to the more important treatises and monographs on ornithology, mammalogy, ichthyology, herpetology, and amphibiology of the twentieth century. Included are general treatises and numerous periodicals and serials, monographs on vertebrate palaeontology, zoogeography, ecology, psychology, bionomics, experimental zoology, etc., likely to interest the advanced student and the librarian...The *second* section is the largest and most valuable for both the research student and the librarian —a partially annotated *Catalogue* of the vertebrate zoological items in all the University libraries, forming a very large selection of important works on that vast subject..."

The chapters in which the outstanding literature on cold-blooded vertebrates is tersely but well discussed are Chapter 15, "Important treatises on ichthyology from the earliest times to the present," and Chapter 16, "Selected titles from the literature of herpetology and amphibiology." In these the Catalogue, which forms the bulk of the volume, is rich in references to older and rarer works, but naturally makes no pretense toward completeness in the larger field of modern literature. Ichthyologists will find the Catalogue useful as a supplement to Dean's *Bibliography.* All vertebrate zoologists will profit from the historical summary of the literature in their own fields, and brother bibliophiles will appreciate the ardor of the collector and compilor, Casey A. Wood, through whose generosity and interest the McGill libraries obviously have derived much of their outstanding richness in the field covered by this "Introduction." —CARL L. HUBBS, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

A HISTORY OF FISHES. By J. R. Norman. Ernest Benn, Ltd., London, and Frederick A. Stokes Co., New York, 1931, xv+463 pp., 9 pl. and 147 fig. Price 28/—, or $7.50.—This proves to be by far the best popular treatise on general ichthyology in the English language: best because in every way strictly up-to-date; because wisely organized; because diligently cross-referenced, and well indexed; because appropriately, neatly and thoroughly illustrated; because the material has been selected with such rare good judgment and care that little is included which any well trained and general ichthyologist would not be expected to know; because, nevertheless, the whole natural history of fishes is roundly presented, with the exception of certain of the most technical aspects, and, finally, because the work neither presupposes nor demands any antecedent biological training. While primarily intended for the general public, there is no other one work so valuable to the special student, for its mastery alone will very satisfactorily suffice as a broad foundation in general ichthyology. This book, along with his many technical contributions, secures the author, along with his predecessors in the curatorship of fishes in the British National Museum, a place among the master ichthyologists of the world.

The very high standard of accuracy evident throughout the volume serves only to accentuate the occasional uncritical or erroneous statements which no work of such size or limits could avoid. Such items as attributing a length of 20 feet to alli-

gator gars, and the reference of *Campostoma* to the *Catostomidae*, can well be modified or eliminated in the next edition.—Carl L. Hubbs, *University of Michigan, Ann Arbor, Michigan.*

The Fishes of the Indo-Australasian Archipelago VI Perciformes (continued). Families: Serranidae, Theraponidae, Sillaginidae, Emmelichthyidae, Bathyclupeidae, Coryphaenidae, Carangidae, Rachycentridae, Pomatomidae, Lactariidae, Menidae, Leiognathidae, Mullidae. By Max Weber and L. F. de Beaufort. E. J. Brill, Ltd., Leiden, 1931: i-xii, 1-448, fig. 1-81. Price in Dutch Guilders, 14.25; in cloth binding, 15.75.—It is with much satisfaction that ichthyologists everywhere watch the continued production of this monumental work, which will long remain indispensable in any serious research on the systematics of the Indo-Pacific fishes: the great mother fish fauna of the world. This volume maintains the style and standards of those which preceded. The treatment of species will appeal to some as here and there too conservative, but the complete synonymies will serve as a basis for the division of such species as may have been thrown together. The announced adherence of the authors to the law of priority will be generally welcomed. The descriptions are good, and the list of East Indian records and general statement of range useful. This volume carries the Perciformes well toward completion; there remain for treatment, in the volume or volumes which we trust will soon follow, the remainder of the more typical spiny-rayed fishes, and some of their specialized offshoots.—Carl L. Hubbs, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

Life-Histories of the Frogs of Okefinokee Swamp, Georgia. North American Salientia (Anura) No. 2. *By Albert Hazen Wright.* The Macmillan Company, New York, 1931, xv+1-497 pp., frontisp.+45 pls., 1 text fig. $8.00.—Much scattered literature exists on the Salientia of the Atlantic coast region, but synoptic works with adequate detail are surprisingly scarce. Dr. Wright, with characteristic energy, clearness of conception and scope of vision, has provided a valuable manual, treating of the species which inhabit the Okefinokee. Following a brief introduction outlining the material, manner of treatment and previous work, he provides a general discussion of the Salientia inhabiting the region, dealing with all of the life processes on which he had data in hand (pp. 15-106). Then follow detailed life-histories of the 21 species admitted to the list. Eggs, larvae and adults are described minutely, and series of measurements in various growth stages are provided, together with exact keys to eggs and larvae. The illustrations are particularly meritorious, comprising in the general account photographs of egg masses, mature larvae and adults together with drawings of the mouthparts of mature larvae. These are grouped together so that the student with specimens in hand may readily make comparisons and effect identification easily. The account of each species is accompanied by plates showing the characteristic habitat and various larval and adult stages. In the text accounts of species, full quotations of pertinent material from previous writers is included, each chapter concluding with a list of references pertaining to the species. The treatment includes not only data on the species as they occur in the Okefinokee but from any part of the range, including both previously published accounts and much of the author's own original and heretofore unpublished field data. Throughout the text there is critical and interpretative comment (as on *Hyla andersoni*, p. 229), reflecting the many years of study given to this group of animals.

Students of amphibiology are again under general debt to Dr. Wright (as for his 1914 work on the Ithaca Anura) and persons interested in the use of amphibia for physiological or other studies will find here a wealth of exact detail; phenologists are provided with many data relating the seasonal programs of amphibia to other phenomena.

The frontispiece is a portrait of Dr. Leonhard Stejneger "nestor of American herpetology."—Tracy I. Storer, *University of California, Davis, California.*

The Turtles of the Northeastern States. By C. Ralph De Sola. Bull. N.Y. Zool. Soc., 34, No. 5, Sept.-Oct., 1931: 131-159, illus.—The area discussed consists of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New

York, New Jersey, Pennsylvania, Delaware and Maryland, or the northeastern coastal plain. There is a key to the identification of species, a distributional map, a text in which is discussed size, color, habits and economic importance of each of the nineteen species included, and a series of excellent photographs.

It is unfortunate that Figure 3, purporting to be a loggerhead, is really a green turtle, *Chelonia mydas*, and that Figure 12 is not a typical eastern painted turtle as labelled, but an intergrade between the eastern form and *Chrysemys picta marginata*.

Several remarks in the text invite comment. On page 149 the statement that the map terrapin is "evenly distributed over the entire area considered in this article" and on page 145 the statement that (among others) the spiny soft-shelled, "Mud Box" and red-bellied terrapins "appear in equal abundance over the entire area shown on the map" are quite inaccurate. The first two turtles are known in the six New England states only from one restricted area on the eastern shore of Lake Champlain in Vermont; the "Mud Box" terrapin, *Kinosternon subrubrum subrubrum*, if entering New England at all, is only to be found in the southern counties of Connecticut; while the red-bellied terrapin has been taken only in Plymouth County, Massachusetts. The statement, regarding the latter form, that it is "used by the natives as an article of food" is certainly news to the writer.

Exception might also be taken to the statement on page 146 that "along with the painted terrapin it (the box tortoise) is the commonest species of the eastern United States." In Massachusetts the box tortoise is extremely rare except on Cape Cod.

Blanding's turtle, *Emys blandingii*, is not included in the list, although in the Society's collection there are several specimens from various localities in Massachusetts.

The text contains interesting data concerning the habits of the species under consideration and it is to be regretted that errors have been allowed to creep into a publication which has such widespread distribution.—HAROLD L. BABCOCK, *Boston Society of Natural History, Boston, Massachusetts.*

EDITORIAL NOTES AND NEWS

Announcement: 1932 Meeting

THE Society will convene in Washington from Thursday to Saturday, May 5 to 7, for its annual meeting of 1932. The main sessions will be held in the National Museum, but there will also be a trip to the National Zoological Park, where our members will enjoy the delightful new Reptile House. The local committee consists of Dr. William M. Mann, Chairman, assisted by Maurice K. Brady and Doris Cochran. The Hotel Washington has been selected as headquarters.

A well attended and very interesting meeting is anticipated. Titles of papers for presentation, with time and other details, should be sent at once to the Secretary, Mr. M. Graham Netting, Carnegie Museum, Pittsburg, Pa.

News Items

DR. Gordon F. Walls has been appointed to a National Research fellowship in Zoology, to continue his investigations of the retina of the lower vertebrates.

Dr. Frances N. Clark has been promoted to the position of Supervising Fisheries Researcher at the California State Fisheries Laboratory.

The Oregon Fish and Game Commission is undertaking a lake and stream survey of the state under the direction of Art M. Fish, and is also establishing a fellowship on water pollution in the University of Oregon.

Dr. L. D. Brongersma, formerly assistant in the Zoological Museum, Amsterdam, has been appointed Curator of Herpetology, s'Rijks Museum voor Natuurlijke Historie, Leiden, Netherlands. Dr. F. P. Koumans has taken the place of the late Dr. Canna M. L. Popta as Curator of Ichthyology in the same institution.

Hsien Wen Wu, one of the fast-growing group of Chinese ichthyologists, has been studying Chinese flatfishes for two years at the Paris Museum.

Junji Oyama, Japanese herpetologist, is now staying in New York City, where he may be addressed in care of the International House, 500 Riverside Drive.

Yaichiro Okada, another Japanese herpetologist, and one of the most prominent and active of the younger group of Japanese zoologists, will visit America in June, on his way to England.

The publication in the United States of *Illustrations of Japanese Aquatic Plants and Animals*, of which Volume I was reviewed in COPEIA, 1931, No. 3, has been taken over by Stanford University Press, Stanford University, California. A price of $50.00, postpaid, is announced for this magnificent set.

Obituary—John W. Titcomb

IN the recent death of John W. Titcomb, Superintendent of the State Board of Fisheries and Game of Connecticut, America has lost one of its foremost fish-culturists, internationally known for his work on fish-cultural methods, on the introduction of American fishes into other countries, and, most recently, for his sponsoring of extensive inquiries into the nutrition of trout.

Correction

IN "Notes on *Batrachoseps*", published in COPEIA, 1931, No. 3, the locality given for *Batrachoseps a. pacificus* in lines 3 and 4, page 133, should read: on the islands of Santa Cruz and Santa Rosa.

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